DOCUMENT RESUME

ED 405 017 JC 970 070

AUTHOR	Budzyna, Janet; And Others
TITLE	On Target! Strategies for Effective Problem Solving and Critical Thinking in the Workplace.
INSTITUTION	Colorado State Community Coll. and Occupational Education System, Denver.
SPONS AGENCY	Office of Vocational and Adult Education (ED), Washington, DC.
PUB DATE	95
CONTRACT	V198A40264-95
NOTE	131p.; Prepared as part of the Educational Partnerships in Colorado project administered under the Adult Education Act (PL-100-297) as amended by the National Literacy Act of 1991 (PL-102-73); for related modules, see JC 970 068-072.
AVAILABLE FROM	CCCOES Workplace Learning, 1391 N. Speer Blvd., Suite 600, Denver, CO 80204-2554 ($30).
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC06 Plus Postage.
DESCRIPTORS	*Adult Education; *Class Activities; Creative Thinking; Curriculum Development; Decision Making Skills; *Inplant Programs; Learning Activities; Postsecondary Education; *Problem Solving; Troubleshooting; Workshops

ABSTRACT

One of a series of workplace education modules, this 6-week module presents activities and materials designed to lead participants through a systematic approach to problem-solving in the workplace. Following a brief overview, indicating that the module emphasizes five phases in problem-solving (i.e., using key problem-solving concepts, identifying the problem, exploring solutions, implementing the solutions, and reviewing outcomes), the levels of difficulty of the module activities are described. Two activities are then presented to help students assess their own problem-solving strengths and weaknesses prior to participating in a problem-solving class or workshop. The module then presents 44 activities and exercises related to the following 7 topic areas: (1) the relationship of organizational culture to problem-solving; (2) concepts of problem-solving, including fluency, flexibility, elaboration, and originality; (3) problem identification; (4) solution identification; (5) solution implementation; (6) analyzing outcomes and the process; and (7) individual versus group problem-solving. Each activity includes a description of intended learning goals, the difficulty level, the recommended group size, the time needed, and necessary materials. The final section presents an outline of a sample 4-hour problem-solving workshop. (HAA)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 405 017

Janet Budzyna
Anne ReisCyr
Janelle Diller
Patricia P. Nichols
Elizabeth Amidon Smith

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

M. Gershwin

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

JC 970 070

Colorado Community College and Occupational Education System

US Department of Education

BEST COPY AVAILABLE

ON TARGET!

Strategies for Effective Problem Solving and Critical Thinking in the Workplace

EPIC Workplace Learning Project, 1995 - US Department of Education

FUNDING INFORMATION

Project Title:
Educational Partnerships in Colorado (EPIC)

Grant #:
V198A40264-95

Act Under Which Administered:
Adult Education Act (PL-100-297) as ammended by the National Literacy Act of 1991 (PL-102-73)

Sources of Funding:
- Office of Adult and Vocational Education, US Department of Education, Washington, DC
- Local, public and private in-kind match

Executive Co-Directors:
- Mary Crabbe Gerswhin
- C. Patricia Kelley Tank

Disclaimer:
The Colorado Community College and Occupational Education System does not unlawfully discriminate on the basis of race, color, religion, national origin, sex, age, or handicap in admission to, or access to, or treatment or employment in, its education programs or activities. Inquiries concerning Title VI, Title IX, 7 Section 504 may be referred to the Affirmative Action Director, Colorado Community College and Occupational Education System, 1391 N. Speer Blvd., Suite 600, Denver, CO 80204-2554, (303)620-4000, or to the Office for Civil Rights, US Department of Education, 1961 Stout Street, Denver, CO 80294.

TABLE OF CONTENTS

OVERVIEW

SKILL LEVEL DEFINITIONS

ACTIVITY TOPICS

Assessment Methods and Options

1 Tortoise, Hare, Thoroughbred
2 Problem Solving Self-Assessment

Problem-Solving Culture

1 Problem-Solving Culture
2 Factors Which Motivate Problem-Solving Strategies
3 Culture Picture
4 Problem-Solving Meetings
5 Problem Solving is a Process
6 Ready-Aim-Fire

Problem-Solving Concepts

1 Loosen the Brain for Problem Solving
2 What if. . .?

Fluency

1 How Many Squares Are There?
2 Count the *F's*
3 Name That Town
4 Things that Come in 3
5 Bird Brain

Flexibility

1 Join the Dots
2 A Creative Environment Game
3 Banana Split
4 Word Squares
5 What Do You See?

Elaboration

1 Picture Completion
2 Great Granny's Will

Originality

1 Half of 8/Ate/Eight

Problem Identification

1 Brainstorming Techniques
2 Pass-the-Buck Brainstorming

3 F.A.S.T. Brainstorming
4 The Five *Why's?*
5 Targeting the Problem
6 Narrowing the Focus
7 Traps to Avoid

Solution Identification
1 Solution Finding Grid
2 The Christmas Vacation Problem
3 Special Interests Analysis
4 Criteria for Choosing Solutions
5 A Contingency Diagram
6 Lost Ball Problem #1
7 Lost Ball Problem #2
8 Open the Door to a Solution

Solution Implementation
1 Evaluation of Environment
2 Word Ladders
3 Develop An Implementation Plan
4 Bloom's Taxonomy Circle

Analyzing the Process
1 The Final Step

Individual vs. Group Problem-Solving
1 The Camping Problem
2 NASA Exercise
3 Name That Town

SAMPLE 4-HOUR WORKSHOP

OVERVIEW

Although good problem solving skills are important in all aspects of life, they are rarely taught. The six-week problem-solving class or the 4-hour workshop is designed to encourage participants in creative and critical thinking skills and to lead them through a systematic approach to solving real and simulated problems. Because the success of the class or workshop rests on the active involvement of the participants, most of the activities included in this curriculum are interactive. The activities are fun and challenging, but they all encourage the development of a particular aspect of critical and creative thinking. Additionally, participants are asked to identify and solve an actual workplace problem.

During the problem identification, solution identification, and solution implementation stages of workplace problems, participants are led through a variety of sequential steps which are part of a successful problem-solving strategy. These steps emphasize that successful, thoughtful problem solving is a ***process***. The integration of brain-teasers and shorter problem-solving tasks helps keep the participants focused, creatively challenged, and encouraged.

The material presented in this manual reflects not only an accumulation of interesting and effective activities, but also reflects the *"Ready-Aim-Fire"* problem-solving strategy, a successful approach to problem solving that includes the following phases: recognizing and utilizing the four basic concepts of problem-solving (*fluency, flexibility, elaboration, and originality*), identifying the key problem, exploring and choosing solutions, implementing the solutions, and reviewing the completed process.

Understanding that *effective problem solving is a process* will impact future problem-solving tasks. This process will energize creative and critical thinking and make the task more focused, efficient, productive, and...*ON TARGET!*

Editor: Patricia P. Nichols, Pikes Peak Community College, Colorado Springs, CO

Contributing Authors:

Janet Budzyna, Pikes Peak Community College, Colorado Springs, CO
Anne Reis Cyr, Community Colleges of Denver and Aurora, Denver, CO
Janelle Diller, Pikes Peak Community College, Colorado Springs, CO
Patricia P. Nichols, Pikes Peak Community College, Colorado Springs, CO
Elizabeth Amidon Smith, Community College of Denver, Denver, CO

Proofreader: Sharon Atwater, Pikes Peak Community College, Colorado Springs, CO

SKILL LEVEL DEFINITIONS

The categories below serve as guides for instructors unfamiliar with a particular activity. It is difficult to acurately label an activity as Beginning, Intermediate, or Advanced because so much of the activity's success depends on the cognitive and creative abilities of the students. What may be "Beginning" for one group could easily be "Intermediate" or "Advanced" for another. Therefore, it is left to the instructor's discretion which activities are best suited for a specific purpose or group.

The arrangement of activities within each section is random rather than prescriptive and does not suggest a sequential order of presentation. If the success of one activity depends on the previous presentation of another activity, it is indicated. Otherwise, choose the activities in the order that best suits the needs of the class or workshop and best supports the problem-solving process.

- ● **BEGINNING:** (about 5 to 10 minutes) These activities are low-key and non-threatening ventures into problem solving tasks. They are short, simple and fun. They gently engage the brain in the process of critical thinking. They may be used as ice breakers and are usually individual tasks.

- ■ **INTERMEDIATE:** (about 10 to 30 minutes) These activities require more diligence and are more mentally challenging; answers will remain elusive for some participants. These activities are less threatening when done in pairs or small groups; individuals can be encouraged and led through the "discovery" process by other participants.

- ◆ **ADVANCED:** (about 15 - 60 minutes) These activities can be mentally strenuous and are typically done in groups. Participants usually work through a series of steps or tasks to accomplish a goal or solution.

ASSESSMENT METHODS AND OPTIONS

The activities in this section help students recognize and assess their problem-solving strengths and weaknesses prior to participating in a problem-solving class or workshop. There are no specific assessment instruments designed for this module because the activities and the actual working through a workplace problem serve as sufficient assessment for the instructor and students. The metacognitive phase at the end of the problem-solving process again addresses the success or failure of the process and the strategies of individual participants in that process. The end result of the problem-solving process, whether worked through in a class or workshop, serves as an effective post-assessment. In a class situation where students work through a workplace problem, the implementation plan they generate can be submitted to management as a real-life post assessment.

TORTOISE, HARE, THOROUGHBRED

Learning Goals:

- To get students acquainted with one another
- To prompt students to think about their problem-solving strategies
- To raise awareness that different people have different problem-solving strategies

Level: All

Group Size: 6-30

Time: about 1-1/2 minutes per person

Preparation and Materials: Handout: *Tortoise, Hare Thoroughbred Descriptions*
Pictures of hare, tortoise, thoroughbred
Masking tape

Learning Activity:

Prior to class, tape the pictures of the three animals in three different locations in the room. After class has begun, have each student read the descriptions of the three animals and determine which animal they most closely represent relative to their problem-solving strategies. Then, ask the students to locate themselves under the respective pictures. Explain to students that there is no right or wrong category. Ask individual students to introduce themselves and explain why they have identified themself as a hare, tortoise, or thoroughbred.

***Discussion Questions**

1. What merit, if any, do you see in the way people in the other two animal groups solve their problems.
2. Do circumstances or particular problem-solving tasks require adopting a different style or approach?

***Variations** For a group smaller than 6 , students can remain seated and simply share with one another after they read the animal descriptions.

Remarks: This is an activity which really lends insight to the different

problem-solving strategies. If the group cannot see the merits of one another's problem-solving characteristics, help them by citing examples where one strategy would be preferable to another.

References:

Kroehnert, Gary. *100 Training games*. Sydney: McGraw-Hill Book Company, 1992.

TORTOISE, HARE, OR THOROUGHBRED?

The Descriptions

Tortoise:

Likes to move ahead slowly and steadily.
Won't be rushed.
Finds strength from pulling in head.
Has a strong protective shell.
Doesn't take unnecessary risks.
Prefers life on an even keel without crisis.
Sets own pace, takes one thing at a time.

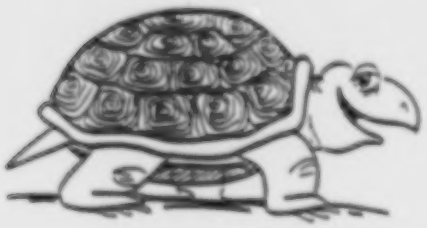
Hare:

Moves with quick starts and stops.
Produces well under pressure.
Finds strength in exploration and challenge.
Is fragile, agile, and lucky.
Enjoys risks and adventures.
Hops from crisis to crisis, is easily distracted.
Always has many irons in the fire.

Thoroughbred:

Economy and grace of movement.
Varies pace according to situation.
Strength comes from top-flight conditioning.
Always under control.
Thrives on competition and challenge.
Has clear goals with mileposts to mark progress.
Always has something left for the stretch.

TORTOISE



HARE

THOROUGHBRED

PROBLEM SOLVING SELF-ASSESSMENT

Learning Goals:

- To focus thinking on problem-solving strategies
- To identify individual strengths and weaknesses

Level: ●

Group Size: Any

Time: 5 minutes

Preparation and Materials: Handout *Problem Solving Self-Assessment*
Pens or pencils

Learning Activity:

Use this self assessment as a prelude to a discussion on the problem solving concepts of "fluency," "flexibility," "elaboration," and "originality." Have students read the statements in the left column and simply place an "x" in a box on that row which best describes or completes the statement at the beginning of each row.

***Discussion Questions**

1. Had you thought of your problem solving strategies before?
2. Have you been able to demonstrate your strengths at work?
3. Have you had any opportunities to improve on your weaker areas?

***Variations**

Remarks: If this assessment is given at the beginning of a class or workshop, refer to the exercise again at the end of the session to determine if the students have any new insights or modifications.

References:

Bladen, Ashby. *How to Cope with the Developing Financial Crisis*. New York: McGraw-Hill, 1979

PROBLEM SOLVING
Self-Assessment

	I don't want to get involved; avoid!	I feel very insecure in this area even if I have some good ideas.	I am building confidence in this area, but I could do better.	I am very good in this area, but there is room for improvement.	This is a personal strength of mine.
My general approach to solving problems on the job is. . .					
I come up with original ideas when solving problems on the job.					
I am able to see the problems and solutions from many different perspectives.					
I am able to piggy-back on others' ideas when solving problems on the job.					
I am usually able to come up with many ideas for solving problems on the job.					

THE PROBLEM SOLVING CULTURE IN THE WORKPLACE

Before any problem-solving curriculum can be effectively initiated in the workplace, employees must have a realistic understanding of how the atmosphere or culture in that workplace hinders or contributes to the development or implementation of good problem-solving skills. When the participants in a class or workshop get excited about what they learn and then discover that they are not allowed to put these skills into practice, the curriculum is essentially invalidated. For the process to take hold in "real time," the atmosphere must be conducive to the process and foster the development of creative and critical thinking. The activities in this session focus on the problem-solving realities in a specific workplace or environment.

PROBLEM-SOLVING CULTURE

Learning Goals:

- To analyze the workplace culture for potential effective problem-solving situations
- To prompt student "buy-in" into potential problem-solving tasks in their workplace

Level: ●

Group Size: Any

Time: 20-30 minutes

Preparation and Materials: Handout *What is the Culture at your Workplace for Problem Solving?*
Problem-Solving Culture

Learning Activity:

Distribute the handouts. Have students consider the questions on the "What is the Culture. . ." handout. This initial activity can be instructor- guided or an open-ended discussion. On the "Problem-Solving Culture" handout, ask the students to list those specific factors in their respective workplaces which hinder or contribute to effective problem-solving.

***Discussion Questions** None

***Variations** None

Remarks: None

References: None

WHAT IS THE CULTURE AT YOUR WORKPLACE FOR PROBLEM-SOLVING?

- Who is usually involved?
- Who has the final say?
- What avenues are there for solving problems?
- Are different kinds of problems solved by different people? (technical, clerical, management)
- Are you encouraged as an individual to participate in solving problems?
- Are your ideas taken seriously?
- Are the "Basic Principles" and "Ground Rules" followed at your workplace?
- How does adherence to rules vary from department to department?

PROBLEM-SOLVING CULTURE

Instructions: List existing workplace conditions which contribute to or hinder good problem solving in your workplace.

Contribute	Hinder

FACTORS WHICH MOTIVATE PROBLEM-SOLVING STRATEGIES

Learning Goals:

- To evaluate personal achievements, motivators and criteria which affect problem-solving strategies
- To understand how and why different people are motivated and what criteria they might use in a problem solving context

Level: ■

Group Size: 4 or more students

Time: 20 - 30 minutes

Preparation and Materials: Handout *Motivators' Grid*

Learning Activity:

Give each student a copy of the handout. Ask them to place their achievements in the space provided at the top of each column on the handouts. Then, have them check the motivators (i.e. criteria) for each particular achievement.

*** Discussion Questions**

1. What motivates your achievement?
2. Did you check the same motivators for each achievement?
3. How does this information relate to choosing criteria for solving a particular problem?
4. How can you use this information to clarify criteria for solving problems?

*** Variations:** This activity can be used as an icebreaker and to develop awareness. It can also be used within the context of a team skills class on problem solving. The discussion would focus on the difficulty in reaching consensus on issues if

each person in a team is coming from a different perspective. In a more sophisticated class the exercise may be used as a spring board to have the class look at what criteria should be considered while solving a specific workplace problem.

Remarks:

This exercise deals with some personal issues. Be sensitive to students' comfort level when asking them to share their results with the class.

References:

Nilson, Carolyn. *Team Games for Trainers*, McGraw Hill Inc., New York, 1993.

MOTIVATORS' GRID

ACHIEVEMENTS

MOTIVATORS / CRITERIA										
money										
recognition										
pleasure										
challenge										
sense of accomplishment										
obligation / duty										
pressure										
winning										
acceptance										
friendship										
humanitarianism										
connections										
security										
freedom										

Adapted from *Team Games for Trainers.* Nilson, Carolyn. McGraw Hill Inc. San Francisco. 1993.

CULTURE PICTURE

Learning Goals:

- To visualize the culture of problem solving in the workplace
- To discuss roles and responsibilities in the problem solving process

Level: ■

Group Size: 4 - 6

Time: 30 minutes

Preparation and Materials: Flipchart paper
Colored markers, colored paper, stickers, tape, glue, scissors, string, etc. for creative work

Learning Activity:

Ask students to write about the factors which promote or deter effective problem solving in their workplace. Discuss the comments. Within each group, have the students create a visual representation of the program solving culture.

*** Discussion Questions**

1. Who solves problems in your workplace? Individuals or teams? Centrally or departmentally?
2. How are problems solved? Is there a documented process? When are problems solved? Are they solved in crisis situations or as preventative measures?
3. Where do you fit in this picture?

*** Variations** If the group of students is from one department, have them look at the culture of problem solving for their department.

Remarks: This activity encourages a left brain and right brain method of building awareness of the problem solving culture.

References:

McCarthy, Bernice. *The 4MAT System: Teaching to Learning Styles with Right/Left Mode Techniques.* Barrington: Excel, Inc., 1980.

PROBLEM-SOLVING MEETINGS

Learning Goals: • To participate effectively in group problem solving meetings

Level: ■

Group Size: 4 or more students

Time: 10 minutes per meeting

Preparation and Materials: Handout *Characterisitics of a Good Team Leader/Team Member*

Learning Activity:

Have the class brainstorm a list of workplace problems which they could solve in upcoming classes. Then, hold three team problem-solving "meetings". Select a different facilitator for each meeting. Each meeting lasts 10 minutes (maximum). Rate each facilitator on each of the following criteria:

1) Encourages participation
2) Supports good ideas
3) Keeps team goals in mind.

Possible topics for each of the meetings:

Meeting 1: From the list of problems brainstormed, discuss which problems are "solvable" and which could not realistically be solved. Eliminate the "unsolvable" problems from the list.
Meeting 2: Choose the top three problems from the list.
Meeting 3: Reach consensus on which problem will be solved as a class in upcoming sessions.

*** Discussion Questions**

1. How well did each student participate?
2. What was difficult/easy about reaching goals as part of a team?

*** Variations:** None

Remarks: None

CHARACTERISTICS OF A GOOD TEAM LEADER

1. **Organized**
2. **Encourages participation**
3. **Keeps team on track**
4. **Gives positive feedback**
5. **Gives constructive feedback when appropriate**
6. **Is open to the opinions and ideas of other team members**
7. **Is committed to team goals**
8. **Delegates responsibility when necessary**
9. **Takes accountability for team actions and decisions**
10. **Communicates team decisions to outside parties**

CHARACTERISTICS OF A GOOD TEAM MEMBER

1. **Encourages participation in others**
2. **Keeps team on track**
3. **Participates**
4. **Is committed to team goals**
5. **Gives constructive feedback**
6. **Is open to the opinions and ideas of other team members**
7. **Listens to the opinions of other team members**
8. **Accepts and supports team decisions**

PROBLEM SOLVING IS A PROCESS

Learning Goals:

- To contrast the way we usually solve problems with a more systematic strategy
- To cause students to reflect on the way problems are solved in their workplace

Level: ●

Group Size: Any

Time: 5 - 10 minutes

Preparation and Materials: Handout *"Typical" Problem-Solving Method*
Systematic Problem-Solving Method

Learning Activity:

Distribute the *Typical Problem-Solving Method.* Give them time to nod and laugh in agreement and then distribute the *Systematic Problem-Solving Method.* Ask them to identify which strategy they personally prefer and use, which strategy is implemented in their workplace, and which strategy is more effective.

***Discussion Questions** None

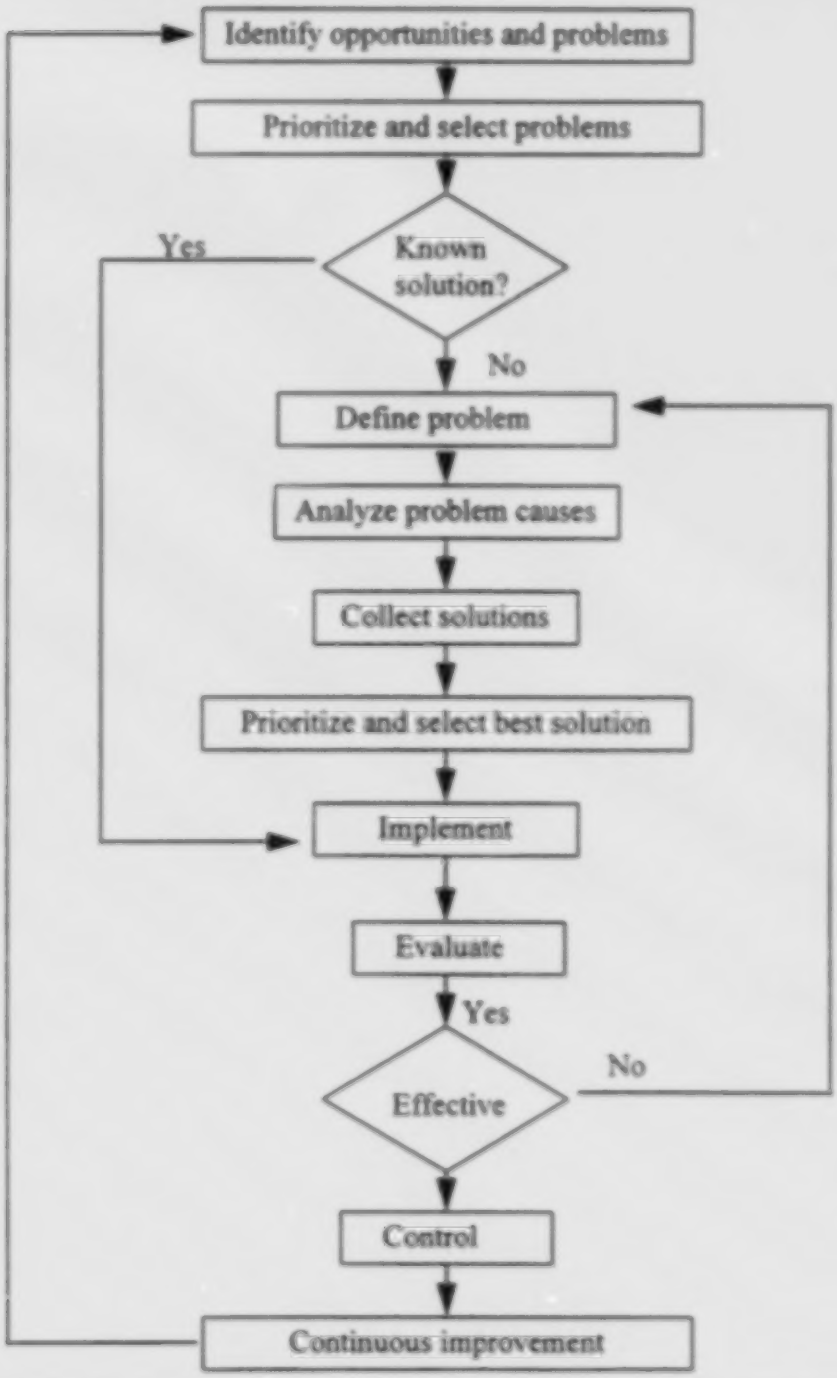
***Variations** None

Remarks: This activity sets the tone for the problem-solving curriculum to be presented and generates some "buy-in" from the students. It's a good activity to use as a transition to the phases of the problem-solvling process.

References: None

"Typical" Problem-Solving Method

Systematic Problem-Solving Method



READY-AIM-FIRE

Learning Goals:

- To demonstrate a systematic approach to problem solving
- To encourage students to adequately define a problem, explore an appropriate solution, and implement the solution with clear action steps

Level: ■

Group Size: Any

Time: 5 minutes

Preparation and Materials: Handout *Ready-Aim-Fire*
Overhead and transparency of above

Learning Activity:

Rather than actually being an activity, "Ready-Aim-Fire" is an ordered approach to problem-solving and can provide a framework for the presentation of activities in a problem-solving class or workshop. Distribute handout and/or project transparency at the beginning of a problem-solving class or workshop to show students the sequencing of the curriculum as you proceed through the phases included in the "Ready-Aim-Fire" problem-solving strategy. Refer to this handout or project the transparency again at the beginning of each phase so students can recognize the progression. The activities in this manual are categorized according to this strategy and can be plugged into the phases as needed and as the level of the group dictates.

***Discussion Questions** None

***Variations** None

Remarks: None

References: None

READY-AIM-FIRE

An Effective Strategy for Problem Solving

- **LOOSEN THE BRAIN**
  - *Fluency*
  - *Flexibility*
  - *Elaboration*
  - *Originality*

- **READY--**
  - *Brainstorm to define the problem*
  - *Identify the "real" problem*
  - *Narrow the focus to make the problem more manageable*
  - *Write a problem statement*
  - *Collect the data*
  - *Organize and analyze the data*

- **AIM--**
  - *Generate and explore solutions*
  - *Examine criteria*
  - *Explore special interests*
  - *Use the solution-finding grid to select an appropriate solution*
  - *Write a solution statement*

- **FIRE--**
  - *Develop an action plan*
  - *Implement the plan*

- **ANALYZE THE PROCESS--**
  - *Review the process and outcome: Metacognition*

PROBLEM-SOLVING CONCEPTS

Activities to foster the development of *fluency, flexibility, elaboration* and *originality* in creative and critical thinking are presented in this section. The activities are arranged in categories according to the skills they foster. These skills are integral to the many phases of effective problem solving. They are clearly evident among members of a problem-solving task force or committee who identify the problem, find a solution, and implement that solution. Individual problem-solvers must recognize which of these skills are their strongest or weakest so they can better understand and improve their own problem-solving strategies.

LOOSEN THE BRAIN FOR PROBLEM SOLVING

Learning Goals:

- To introduce and define the problem-solving concepts of ***fluency, flexibility, originality***, and ***elaboration***.

Level: ●

Group Size: Any

Time: 10 minutes (introduction only)
60 minutes (demonstration with activities)

Preparation and Materials: Handout *Fluency, Flexibility, Originality, Elaboration Problem-Solving Concepts*
Overhead and transparencies of each handout

Learning Activity:

Distribute handouts or project transparencies. Introduce these concepts as tools or tricks to loosen the brain and foster critical thinking. Explain that these concepts are integral to effective problem solving and that individuals manifest these to varying degrees in a problem-solving task. Use the activities in this section to demonstrate and further clarify how these concepts operate within problem solving and how students can develop them.

***Discussion Questions**

1. Which concept do you easily demonstrate within a problem-solving task? Which ones do you need to develop?

2. How can these concepts hinder or influence an individual problem-solving task? A group problem-solving task?

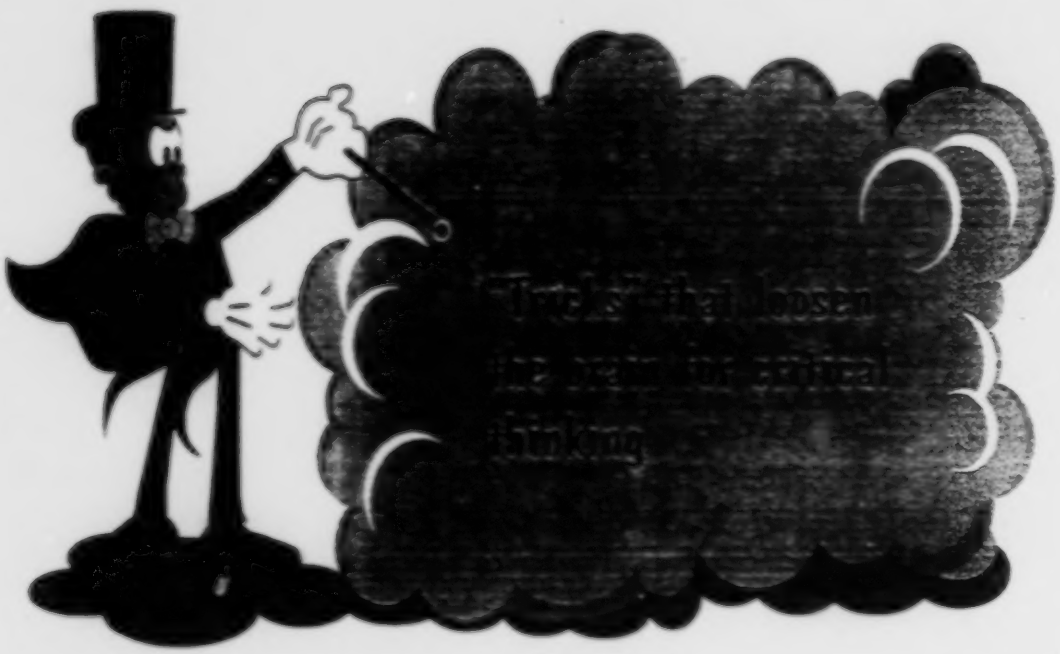
***Variations** Introduce these concepts all at once and follow with corresponding activities, or introduce them one at a time along with the corresponding activities.

Remarks: This activity can follow the completion of the Problem Solving Self-Assessment (Assessment 2).

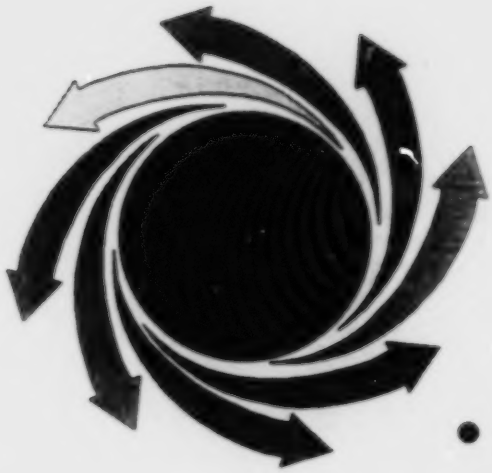
References: None

PROBLEM SOLVING CONCEPTS

- Fluency
- Flexibility
- Originality
- Elaboration



Fluency



- A freeflowing quantity of ideas directed at a problem or solution
- Brainstorming

EPIC Workplace Learning Project, 1995
US Department of Education

Stretching to see things from a different perspective. . .

. . . and stepping out of your "mental box"

EPIC Workplace Learning Project, 1995
US Department of Education

ORIGINALITY

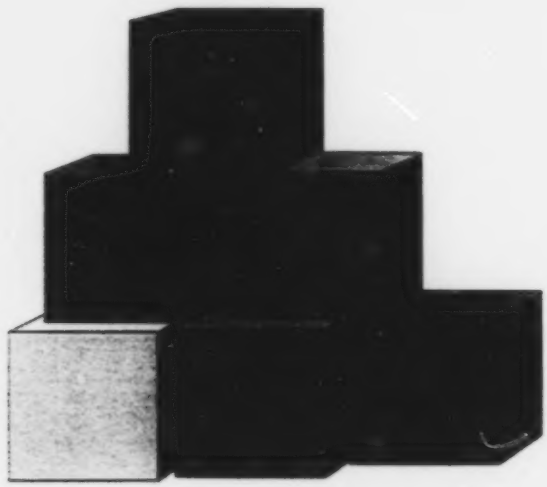
. . .a bright new idea

- Using a fresh pair of eyes to see "new"
- Risking to think creatively
- Offering a workable alternative to "...because we've always done it that way."

EPIC Workplace Learning Project. 1995
US Department of Education

ELABORATION

- Building on someone else's ideas
- Retooling or refining an idea
- "Piggybacking"
- Adding the framework onto an existing foundation



EPIC Workplace Learning Project, 1995
US Department of Education

WHAT IF.....?

Learning Goals:

- To prompt use of all four problem-solving concepts: *fluency, flexibility, elaboration, originality*
- To demonstrate to students how all four concepts are present in any given problem-solving task

Level: ●

Group Size: Any

Time: 15 minutes

Preparation and Materials: Handout *What if...*

Learning Activity:

Introduce or review the problem-solving concepts of *fluency, flexibility, elaboration,* and *originality*. Distribute the handout and ask students to review all four questions. Then, divide the class into 4 groups with each group working on one question. At the end of the allotted time, ask the groups to share their ideas and identify which questions and answers exhibit one or more of the concepts.

***Discussion Questions** None

***Variations** This exercise can be done individually.

Remarks: These are but four selections from a marvelous collection of similar questions from Healy's book. They all provoke creative and critical thinking and, in the answering process, manifest the concepts of *fluency, flexibility, originality,* and *elaboration*

References:

Healy, Jane M. *Is Your Bed Still There When You Close the Door?: And Other Playful Ponderings: How to Have Intelligent and Creative Conversations with Your Kids.* New York: Doubleday, 1992.

EPIC Workplace Learning Project, 1995
US Department of Education

What if.....

....people were born with wheels instead of feet? How would the world be different?

....money grew on trees and everyone could pick as much as needed?

...everything we said floated above us like the conversation balloons in cartoons. How would our communication change?

....people communicated by scent instead of speech? What advantages and disadvantages would there be?

EPIC Workplace Learning Project, 1995
US Department of Education

HOW MANY SQUARES ARE THERE?

Learning Goals:
- To prompt the use of "fluency"
- To encourage a shift of perspective "to see more"

Level: ●

Group Size: Any

Time: 5- 10 minutes

Preparation and Materials: Handout *How Many Squares Are There?*
An overhead of handout, overhead markers

Learning Activity:

This activity forces "fluent" thinking in anticipation of brainstorming activities during problem-solving. Simply ask students to determine how many squares are on the handout or overhead. There are 30 squares. Those students who finish first will probably only see the 16 individual squares and perhaps even the larger square of 16 smaller ones. There are, in fact, 9 groups of 4 squares, and 4 groups of 9 squares. When the students are done, ask for a show of hands. How many found 16, 17, more than 21, etc.? Give an overhead marker to the student who found the most and ask that person to come to the front of the class and trace the boundaries of the "squares" on the transperancy.

***Discussion Questions**
1. How many did you see upon first glance?
2. What enabled you to see more?

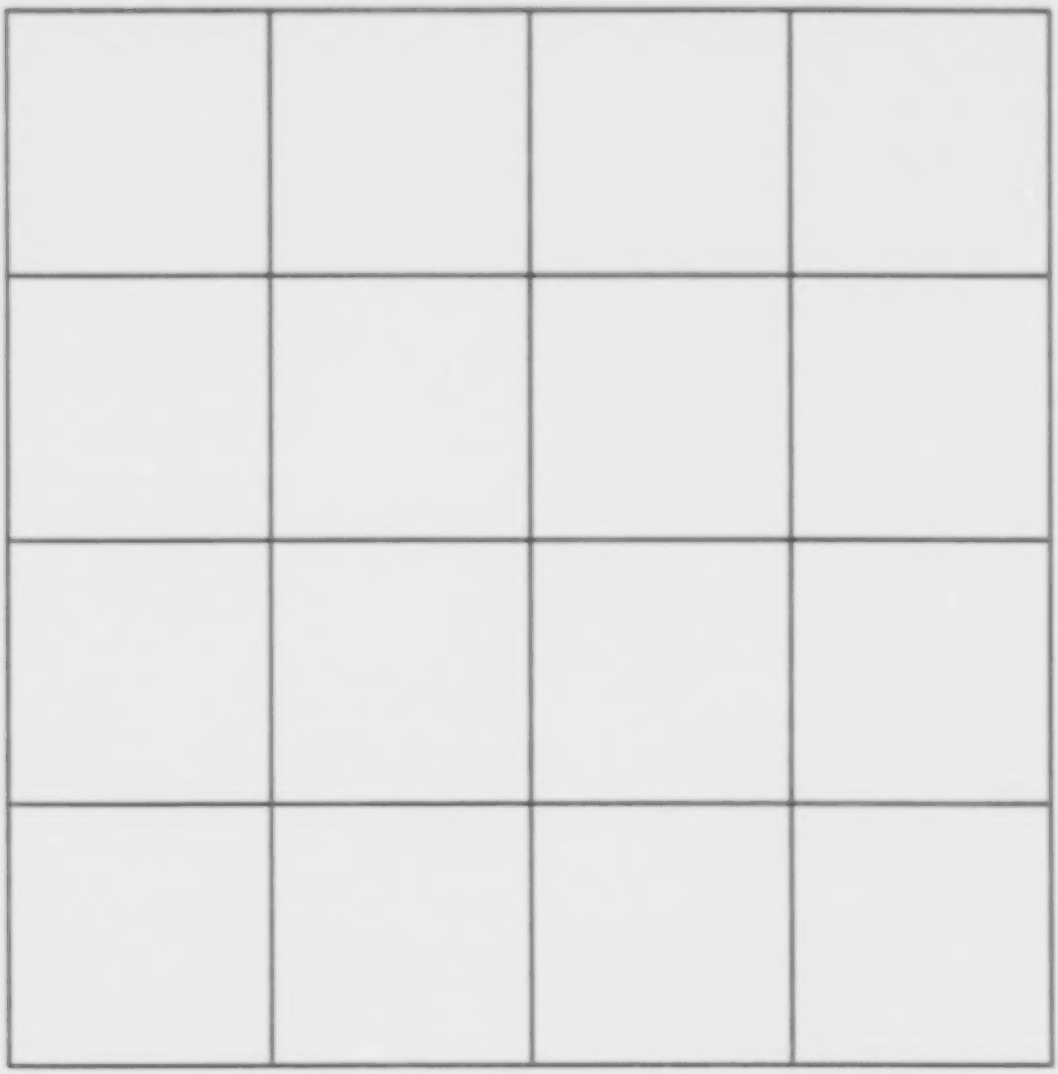
***Variations** None

Remarks: Remind students that as they think about brainstorming in their problem-solving tasks, they must "see more" instead of stopping after the most obvious.

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

HOW MANY SQUARES ARE THERE?



EPIC Workplace Learning Project. 1995
US Department of Education

COUNT THE "F's"

Learning Goals:

- To prompt the use of "fluency"
- To encourage a shift of perspective "to see more"
- To demonstrate how selective perception can limit our creative thinking

Level: ●

Group Size: Any

Time: 3-5 minutes

Preparation and Materials: Handout *Count the "F's"*
A prepared overhead of handout and markers

Learning Activity:

Selective perception can often block creativity and stunt fluency during brainstorming sessions. Most students will quickly read the sentence on the handout and find only 2 "f's"--the first two. Others will find 3. Very few students will locate all 6 of the "f's" in the sentence because the brain "hears" the /v/ sound in the word ***"of"*** rather than the /f/ sound.

***Discussion Questions**

1. How many did you see upon first glance?

***Variations**

This activity may also be used in the "solution identification" phase of problem solving. It illustrates that solutions are often right in front of us and we easily miss them, especially if they involve the familiar.

Remarks: None

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

Read the following sentence:

FINISHED FILES ARE THE RESULT OF YEARS OF SCIENTIFIC STUDY COMBINED WITH THE EXPERIENCE OF MANY YEARS.

Now, count the "F's" in the sentence. Count them only once. DO NOT recount them.

EPIC Workplace Learning Project, 1995
US Department of Education

NAME THAT TOWN

Learning Goals: • To practice "brainstorming "

Level: ●

Group Size: Any

Time: 15 minutes

Preparation and Materials: None

Learning Activity:

Ask the group to individually list as many small towns that they can think of with populations under 5,000. Allow them to work on their list for one minute. Then, break the larger group up into smaller groups of not more than seven people per group. Ask each group to now compile a larger list of small towns from one another's lists and add any additional ones that they can think of.

***Discussion Questions** 1. Did you come up with more responses individually or in a group?

***Variations** None

Remarks: If necessary, lead the group to recognize that having worked together as a group broadened the range of answers as opposed to having worked individually. The cartoon cited below is helpful in leading the group to discuss the merits of group problem solving over individual problem solving.

References: Watterson, Bill. "Calvin & Hobbes," February 2, 1994 Universal Press Syndicate

EPIC Workplace Learning Project, 1995
US Department of Education

THINGS THAT COME IN 3

Learning Goals:

- To prompt "fluency"
- To practice "brainstorming"

Level: ●

Group Size: Any

Time: 3 minutes

Preparation and Materials: Flip chart or board, markers

Learning Activity:

Give the class 3 minutes to brainstorm and call out all the things that they can think of that come in 3's (e.g. triplets, 3 R's, Neapolitan ice cream, Trinity, etc.). Write the responses on the board as they are given.

***Discussion Questions** None

***Variations** Have everyone do this individually and share responses. Eliminate duplicates from the list to come up with a "group" total. This demonstrates to the group the value of collective vs. individual problem-solving when quantity of ideas is an important issue

Remarks: None

References: None

BIRD BRAIN

Learning Goals:
- To prompt "fluency"
- To practice "brainstorming"

Level: ●

Group Size: Any

Time: 5- 10 minutes

Preparation and Materials: Flip chart or board, markers
Paper

Learning Activity:

Give the students one minute to individually write down the names of all the birds they can think of. Ask for individual totals and jot them down on the board. Then, ask the person who had the highest total to call off the names on his list; write these down on the board. Ask the other students to successively call off the names of birds not already listed. The resulting unduplicated total demonstrates the value of group brainstorming over individual brainstorming.

***Discussion Questions**

1. Were you able to think of more names after your memory was jogged by those being listed?
2. Did you have trouble getting started?

***Variations** A 3-minute time limit can be used to give the students more "start-up" time; however the shared list then becomes lengthy and the activity begins to lose its "punch".

Remarks: This is a good transition from the demonstration of "fluency" to "flexibility." If the list included large birds such as "chicken," "turkey,", "penguin," etc., flexibility was demonstrated. Flexibility would be even better demonstrated if the list were to include such "birds" as: "Lady Bird," "Jailbird,", "Larry Byrd," "Bird of Happiness," "Bird of Paradise," etc. If no one thought of these, it's because they didn't step out of their "mental boxes."

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

JOIN THE DOTS

Learning Goals:
- To prompt "flexibility" in problem-solving
- To demonstrate that stepping outside a "mental box" is often necessary to solve a problem

Level: ■

Group Size: Any

Time: 2 minutes

Preparation and Materials: Handout *Join the Dots*
A prepared overhead of handout and solutions, overhead markers

Learning Activity:

The 9 dots on the handout visually form a "box" that can limit the students' creative thinking. Distribute handouts and give the following instructions:

1) Connect all the dots with only 4 consecutive straight lines.
2) Do not lift your pen off the paper or repeat a line.

On the overhead or a flipchart, demonstrate how to solve this problem.

***Discussion Questions**

1. Did you see a "box" at first? Did it preclude your ability to draw lines beyond the "boundaries"?
2. For those of you who "solved" this puzzle, how did you determine where the lines should go?
3. Is thinking outside your "mental box" usually easy or hard for you?

***Variations** Ask students to do this activity with only 3 straight lines.

Remarks: None

References: Kroehnert, Gary. (1991) 100 Training Games Sydney: McGraw-Hill Box Company.

JOIN THE DOTS

EPIC Workplace Learning Project, 1995
US Department of Education

A CREATIVE ENVIRONMENT GAME

Learning Goals:

- To recognize that creative thinking can provide valuable new ideas and perspectives.

Level: ■

Group Size: Any number

Time: 20 minutes

Preparation and Materials: Handout *The Lost Ants, A Creative Environment*
Overhead *Show Me the Way to Go Home*

Learning Activity:

Using the ideas from "A Creative Environment," lead the group through a discussion on creative thinking. Next, explain that creative and flexible thinking will be practiced as a group activity. Distribute the handouts and divide the group into pairs. Project "Show me the way to go home!" and review the instructions. Explain that the partners in each pair must decide who will be the "blind ant" and who will be the "seeing ant". Then, they must determine how they will get the blind ant home without violating the instructions. Answer any questions they may have. Have the pairs demonstrate how they solved the problem.

***Discussion Questions**

1. Is creative thinking part of the problem solving process?
2. How does this activity apply to team problem solving?

***Variations**

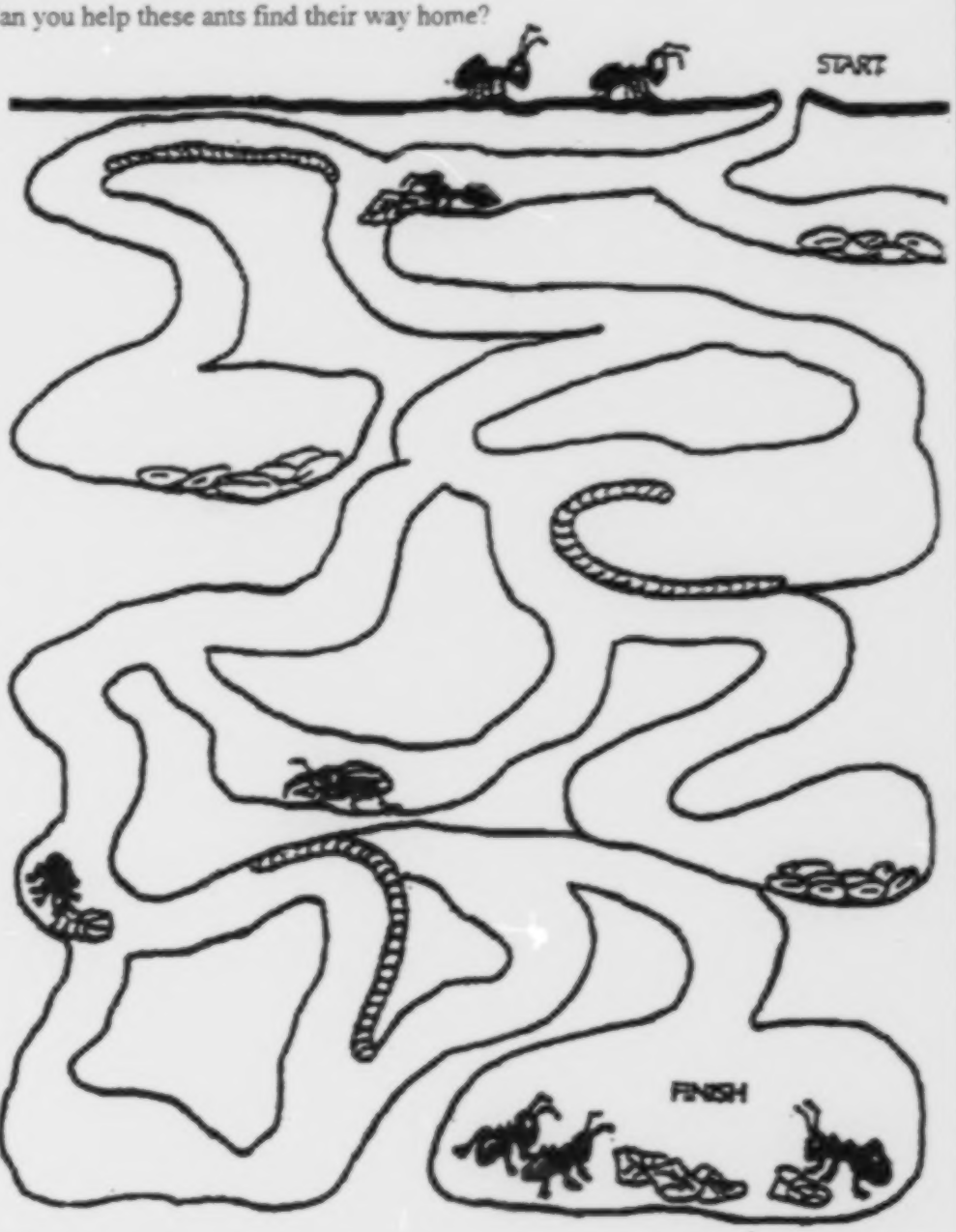
Remarks: One way to get the blind ant home and obey all the game rules is to have the "seeing ant" guide the pencil of the "blind ant" by moving the paper around.

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

THE LOST ANTS

Can you help these ants find their way home?



EPIC Workplace Learning Project, 1995
US Department of Education

A CREATIVE ENVIRONMENT

Creativity can provide us with valuable new ideas and perspectives. Like any critical resource, we can nurture and protect it by learning to:

- Accept that creativity is not something we "learn" but something we've forgotten and can "relearn."

- View creativity as a valid part of your role on the team, regardless of your job or your role definition.

- Focus upon idea generation without judgement; analysis can come later.

- Support and build upon creative ideas from all team members whenever they appear.

- Remember that being creative is an act of faith in our ability to effect positive change in ourselves, our teams, and our organization.

EPIC Workplace Learning Project, 1995
US Department of Education

BANANA SPLIT

Learning Goals:

- To prompt "flexibility"
- To encourage students to look at what is there and see something different, something new

Level: ●

Group Size: Any

Time: 5 - 10 minutes

Preparation and Materials: Flip chart or board

Learning Activity:

Write the following letters on the board: **BSIANXALNETATESRS**. Ask students to copy the letters in order on their paper. Then, tell them, "Cross out six letters in order to end up with a common household word." DO NOT write this instruction. Give it orally. DO NOT alter the instruction. Students will appear puzzled and then begin to cross out various letters. If students can see the words, "six" and "letters" among the other letters and eliminate those two words, they will end up with "banana" as their common household word. If students randomly eliminate 6 letters from the scramble, they will struggle to locate a common household word.

***Discussion Questions**

1. What did your "mental box" prevent you from seeing?
2. Did you ever see the 2 words, "six" and "letters"?

***Variations** None

Remarks:

For those students who still do not understand what they were supposed to do, or for those students who still could not locate "six letters," write "six letters" on the board as "s-i-x-l-e-t-t-e-r-s". Usually, they will "get it" at this point. Transition from this exercise to encourage students to be more willing to change their perspective and stretch their thinking when solving problems and choosing solutions.

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

WORD SQUARES

Learning Goals:

- To prompt "flexibility"
- To encourage students to "see" creatively - to step out of their "mental box"

Level: ■

Group Size: Any

Time: 10 minutes

Preparation and Materials: Handout *Word Squares #1* **or** *Word Squares #2*
Answer Sheet for Word Squares

Learning Activity:

Distribute the handout and ask students to look at the way the words are written and their placement within the box in order to determine the idiom, proverb, or common expression the words represent. When the allotted time is up, distribute the answer sheet.

***Discussion Questions**

1. Do you see any connection between this exercise and problem-solving tasks? What?

***Variations** This exercise can be done individually, in pairs, or as a class. To facilitate "flexible" thinking, ask students to create their own word squares.

Remarks: If students appear to be clueless about how to begin, guide the class through one or two of the puzzles before asking them to do them individually. Be sensitive to the frustration level of the students and continue the activity on another day, if necessary, when they can try again with some idea of how to proceed. Choose one word square activity at a time, and save the other for another day when a brain teaser would be useful.

References:

Kroehnert, Gary. *100 Training Games*. Sydney: McGraw-Hill Book Co., 1991.

Underwood, Tom. *Wuzzles*. Edina: Resources for Organizations, Inc., 1994.

EPIC Workplace Learning Project. 1995
US Department of Education

WORD SQUARES #1

1. MAN --- BOARD	**2.** BAN ANA	**3.** DICE DICE	**4.** T O W N
5. D DEER E R	**6.** 0 --- PhD MD DDS	**7.** F F R STANDING R I MISS I E E N N D D	**8.** DEATH LIFE
9. WEAR --- LONG	**10.** GETTINGITALL	**11.** LAL	**12.** FLYING --- c ccc c c c cc
13. poFISHnd	**14.** AGE BEAUTY	**15.** GROUND --- feet feet feet feet feet feet	**16.** M L E A

EPIC Workplace Learning Project. 1995
US Department of Education

WORD SQUARES #2

1. G E L E N I S F	**2.** ESROH RIDING	**3.** smUPoke	**4.** LEFT PRICE
5. TEEXAMRM	**6.** LISTING LISTING LISTING LISTING	**7.** FORGOTTE	**8.** T P G S P N E I
9. 1. FEET 2. HANDS 3. FACE	**10.** ME/REPEAT	**11.** COextraME	**12.** doinglearn
13. ALL	**14.** I E C EXCEPT	**15.** .that that	**16.** day yesterday

EPIC Workplace Learning Project, 1995
US Department of Education

ANSWER SHEET FOR WORD SQUARES

Word Square #1

1. Man overboard
2. Banana split
3. Paradise
4. Downtown
5. Deer crossing
6. 3 degrees below zero
7. Misunderstanding between friends
8. Life after death
9. Long underwear
10. Getting it all together
11. All mixed up
12. Flying overseas
13. Big fish in a little pond
14. Age before beauty
15. 6 feet underground
16. Square meal

Word Square #2

1. Mixed feelings
2. Horseback riding
3. Up in smoke
4. The price is right
5. Midterm exam
6. Multiple listing
7. Almost forgotten
8. Stepping out of line
9. Feet first
10. Repeat after me
11. Extra income
12. Learn by doing
13. All alone
14. "i" before "e", except after "c"
15. That's beside the point
16. Day before yesterday

EPIC Workplace Learning Project. 1993
US Department of Education

WHAT DO YOU SEE?

Learning Goals:

- To prompt "flexibility"
- To encourage students to shift their perspective in how they see things

Level: ●

Group Size: Any

Time: 5 - 10 minutes

Preparation and Materials: Handout *What do you see?*
Overhead projector and transparency of handout
Overhead markers

Learning Activity:

Distribute handout and/or project the transparency. Give students a 30-second to one-minute time limit to determine what they see. If there are those in the group who have done this before, ask them to remain silent until the others have shared. DO NOT lead them with, "Do you see an old woman or a young woman?" Project the transparency if you haven't already. After everyone has shared, ask someone to come up and trace the outline of the young and/or old woman on the transparency so that those who were "blind" can now "see."

***Discussion Questions**

1. What do you see?
2. Was it easy to see one or the other when someone showed you?
3. How does this apply to problem solving?

***Variations** If time permits, ask an additional question, "Why do you think some can see only the old woman, some only the young woman, and some both?"

Remarks: Some students will be better able to see the images at a distance, on the transparency, if they're unable to do so on the handout in front of them.

References:

Kroehnert, Gary. *100 Training Games*. Sydney: McGraw-Hill Book Company, 1992.

WHAT DO YOU SEE?

PICTURE COMPLETION

Learning Goals:

- To prompt the use of "elaboration"
- To demonstrate the different ways people build upon the same idea.

Level: ●

Group Size: Any

Time: 10 - 15 minutes

Preparation and Materials: Handout *Picture Completion*
Pens or pencils, roll of tape

Learning Activity:

Distribute the handout and ask students to complete the line drawings in any way that they want using pen or pencil. While students are drawing, give each one a small piece of tape and ask them to tape their pictures onto a designated wall or board when they're finished. When all the students have posted their pictures on the wall, ask them to gather around the pictures to observe the differences. Particularly notice if any of them demonstrate "flexibility" by being drawn beyond the lines or if a partially completed figure within the lines must be "completed" beyond the lines.

***Discussion Questions**

1. What do you see as you look at the other pictures?
2. Which ones, if any, demonstrate "flexibility"?
3. Was this exercise hard or easy for you? Why?

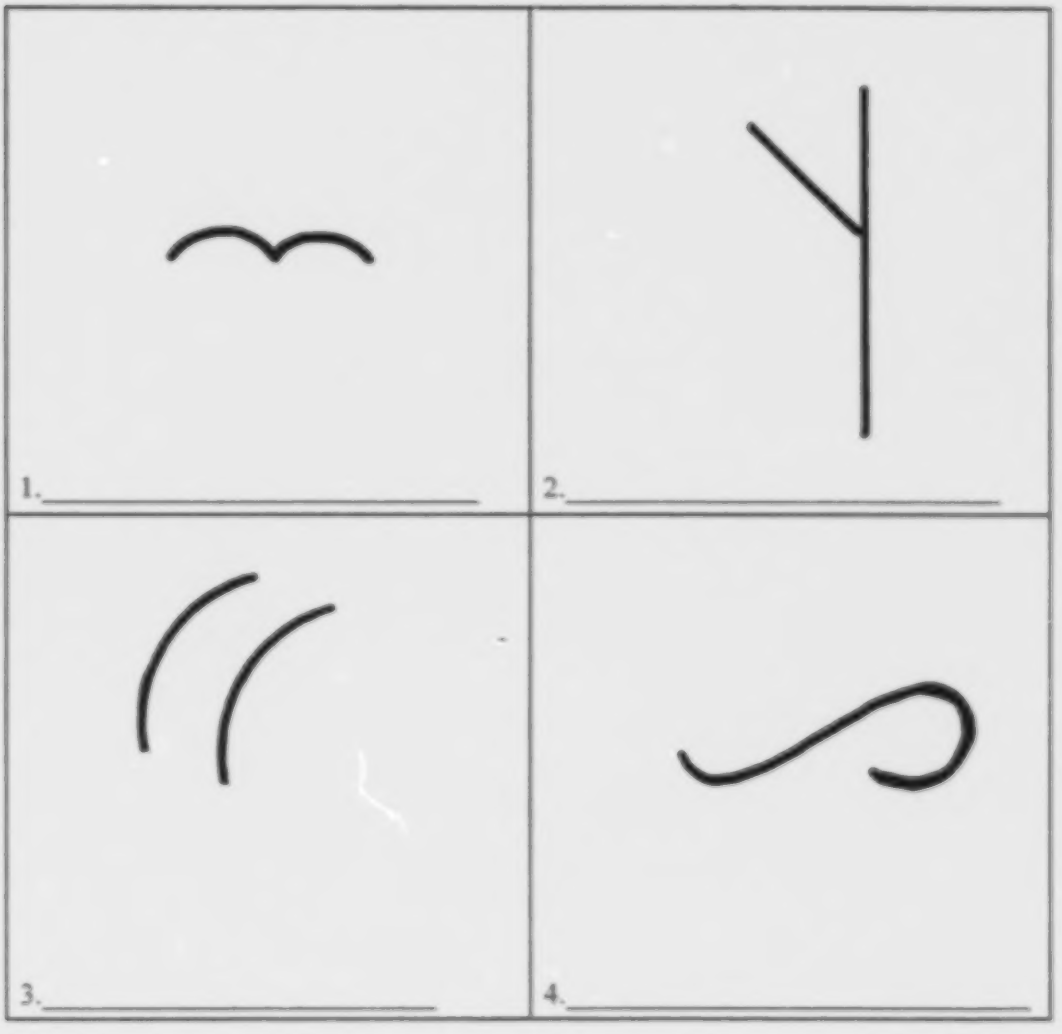
Remarks: The "flexibility" issue is only pertinent if you have taught it. If not, this would be a good time to introduce it along with the concept of "elaboration." This is also a good time to really emphasize the different ways people approach the same task and see the same task, especially when it comes to problem-solving issues.

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

PICTURE COMPLETION

By adding lines to the incomplete figures on this page, you can sketch some interesting objects or pictures. Try to think of original pictures or objects. Try to make the pictures as complete and interesting as you can by adding to and building on your first idea. Make up an interesting title for each of your drawings and write it at the bottom of each block next to the number of the figure. You can relate all four of your pictures to create a story if you like.



EPIC Workplace Learning Project. 1995
US Department of Education

GREAT GRANNY'S WILL

Learning Goals:

- To prompt the use of "elaboration"
- To collaborate creatively in a problem-solving task

Level: ■

Group Size: Any, but divided into pairs or groups of 3 - 6

Time: 15 - 20 minutes

Preparation and Materials: Handout *Great Granny's Will*

Learning Activity:

This exercise serves as a fun way for class members to begin working together as a group before they delve into more difficult problem-solving tasks. Ask the students to follow the directions on the handout and see what the teams come up with. After the time limit, ask each team to briefly report on their creations. Their ideas serve to reinforce the fact that not everyone thinks the same and that creative thinking is often easier when it involves collaboration.

***Discussion Questions**

1. What, if any, obstacles did you have to overcome in your creative thinking?
2. Was it easy or difficult to collaborate and "elaborate"? Why?

***Variations** None

Remarks: None

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

GREAT GRANNY'S WILL

Great Granny Addison died recently and left your group, her favorite charity, $250,000.00. However, there is one slight "catch" to work out before you receive the money. Great Granny wanted to make sure you would use her money creatively, so in her will she stipulated that you must go through her attic and find some use for every object in it. You are not allowed to sell anything. Of course, many of the items would be automatically discarded as junk by others, so you will really have to "see new". Look at each item in a fresh, original way. Try to discover some really novel uses. The following items are in the attic awaiting your originality:

1. A box of assorted buttons
2. A bunch of faded pictures of Great Granny's friends and relatives
3. One roller blade skate
4. A box of old books
5. One ski pole
6. Four green bandannas
7. A cedar chest
8. A badly scratched Beatles record.
9. A broken set of Sony Walkman earphones
10. 6 empty hat boxes
11. Two old storm windows that don't fit the house
12. A huge, moth-eaten, stuffed panda bear
13. Some biology notes from a class she took in college
14. 17 homemade movies
15. A hood-type hair dryer without a hose
16. 4 pairs of stockings with runs in them
17. A cracked Christmas tree jello mold
18. A large (3' x 4') cracked mirror in a wooden frame
19. 6 plastic Easter baskets in which mice have been playing
20. An accordion with half the keys missing
21. 3 sticks of dynamite without fuses
22. Two quill pens
23. A corset
24. An Atari set without the console (paddles only)
25. 7 old Sears catalogues

EPIC Workplace Learning Project, 1995
US Department of Education

HALF OF 8/ATE/EIGHT

Learning Goals:

- To provide a task which prompts "originality"
- To demonstrate that persons in groups do not interpret problem-solving tasks in the same way

Level: ●

Group Size: Any

Time: 5-10 minutes

Preparation and Materials: Flip chart or board and markers

Learning Activity:

Orally instruct students as follows: "Come up with a creative way to write half of 8." DO NOT write this instruction on the board or on a handout because students will then lock into "eight" or "8" or "ate." You want students to interpret the instruction freely in order to prompt original thinking. When everyone is finished or has quit thinking, ask those who have come up with solutions to recreate their ideas on the flip chart or board for the class to see.

***Discussion Questions**

1. Were you surprised to see that others interpreted this instruction differently from you?
2. How can you apply this insight to other problem solving tasks?

***Variations** Pairs or groups of 3 could easily do this task.

Remarks: This activity clearly prompts originality. Nevertheless, you can encourage "flexibility" by asking the groups the three possible interpretations of the instruction. Prompt them to be "flexible" thinkers and come up with additional ideas.

EPIC Workplace Learning Project, 1995
US Department of Education

PROBLEM IDENTIFICATION

Identifying the problem is the first phase of the problem-solving process. This section includes activities to foster quicker identification and clarification of a problem. The biggest risk to effective problem-solving is having failed to clearly identify the actual problem. If we "assume" the problem and "know" the solution, then we've missed the target. These activities encourage clear definition of a problem through individual and group activities. A common element in these activities is "brainstorming". Brainstorming is a tool which can be easily used by individuals or groups. It is recommended that "Brainstorming Techniques" (Problem Identification 1 in this section) be presented as an introduction to this phase of the problem-solving process.

BRAINSTORMING TECHNIQUES

Learning Goals:

- To familiarize students with brainstorming techniques which they can use in the problem or solution identification process

Level: ●

Group Size: Any

Time: 10 minutes

Preparation and Materials: Handout *Brainstorming Guidelines*
Brainstorming Blockers

Learning Activity:

Introduce the importance of "brainstorming" in the problem solving process. Distribute the handouts and review guidelines and blockers. Ask students to practice these techniques as a group by brainstorming "out loud" as many things that they can think of that are "soft." Give them 3 minutes to do this. Write the ideas on a flip chart or board as fast as they are called out.

***Discussion Questions**

1. Would you have thought of these things on your own?
2. Did you feel stifled or encouraged by the brainstorming process?
3. What are the advantages of using this technique in the problem-solving process?

***Variations**

Have students list "soft" things individually before doing it as a group so they can see the difference in the quantity of responses. Any topic can be used for this exercise.

Remarks:

The scribe must refrain from making any comments or alterations in the transcription of responses. Sustain the free flow of ideas without comment or analysis or discussion for about 5 minutes or until group obviously loses interest or momentum.

BRAINSTORMING GUIDELINES

- **Don't critique ideas.**
  - Don't take time to evaluate ideas; it interrupts the flow of ideas.
  - Evaluating ideas is another, later step in the problem-solving process.
  - Don't kill or discourage contributions with judgmental remarks such as:
    - *That is ridiculous!*
    - *We've already tried that!*
    - *Who ever heard of that?!*

- **Use freewheeling imagination.**
  - Let your mind work freely.
  - Don't prevent ideas from emerging by rigidly adhering to "logical thinking."
  - Don't feel bound by budget, time, staff, or other resource constraints.
  - Share mental images, synonyms, plays-on-words, free associations, and far-fetched ideas.

- **Build on one anothers' ideas.**
  - Combine, expand, hitchhike, piggyback.

- **Aim for quantity.**
  - The more ideas you can bring out, the better.
  - Don't worry about duplicates.
  - You are not aiming for quality at this point, only quantity.

- **Record each idea.**
  - Record each idea on a flipchart exactly as it is presented.
  - Try to keep it brief but faithful to the wording of the presenter.

BRAINSTORMING BLOCKERS

1. That's ridiculous!
2. We don't have the time.
3. We did all right without it before.
4. Let's form a committee.
5. Why fix it if it ain't broken?
6. We've never done that before.
7. We're not ready for that.
8. That's their problem, not ours.
9. Let's get back to reality.
10. Senior management won't agree to that.
11. That's not practical.
12. That will cost too much.
13. We've tried that before.
14. Has anyone else tried it before?
15. It's not in the budget.
16. You can't teach an old dog new tricks.
17. What will the union say?
18. That's not my/our responsibility.
19. Pass on that one.
20. You've got to be kidding!

EPIC Workplace Learning Project, 1995
US Department of Education

PASS-THE-BUCK BRAINSTORMING

Learning Goals:

- To brainstorm problems that might be created by implementing a solution

Level: ■

Group Size: 3 or more students

Time: 20 - 30 minutes

Preparation and Materials: Monopoly Money ($100 increments)
Handout *Checklist for Implementing the Plan*

Learning Activity:

Choose a workplace problem that the class has been solving. They should have a solution decided upon at this time. Ask the students to stand in a circle and pass a $100 bill around. As each student holds the bill, he or she must come up with at least one new problem that would be created by implementing the solution. List the problems on a flip chart. When everyone has come up with a "new" problem, class will discuss the following questions:

*** Discussion Questions**

1. Are the new problems so overwhelming that they would impede implementation of the solution?
2. What steps need to be taken in order to mitigate the effects of the solution implementation?
3. Do you need to review or revise your implementation checklist?

*** Variations:** A tennis ball may be passed around from student to student instead of money. Have students brainstorm solutions for problems by "passing the buck."

Remarks: This activity works well with with a moderately-sized group (4 - 6 students). With a large group, you may run out of "new" problems, especially if the solution is a good one.

CHECKLIST FOR IMPLEMENTING THE PLAN

WHO ?	
WHEN ? TIMELINE:	
HOW ?	
WHERE ?	
Is the solution working?	
Can you check its effectiveness?	
Does it solve the problems it was intended to?	
Does it create new problems?	

EPIC Workplace Learning Project, 1995
US Department of Education

F.A.S.T. BRAINSTORMING

Learning Goals:

- To provide an "affective" approach to brainstorming a problem or solution
- To encourage students to express their personal opinions about a problem or issue

Level: ■

Group Size: Any

Time: 10 - 20 minutes

Preparation and Materials: Handout *FAST Brainstorming*

Learning Activity:

Distribute handouts and ask the students to review the questions. Then, choose a current event, a workplace issue, or a social issue and have the students brainstorm on this issue using the F.A.S.T. approach. Remind them of good brainstorming "etiquette" as described in The Brainstorming activitiy found in this section (Problem Identification 1).

***Discussion Questions**

1. How did you feel using these questions and expressing your personal opinions?
2. When you are involved in a problem-solving task, do you feel "shut-out" when you try to express your opinions? Why?

Remarks: None

References: None

EPIC Workplace Learning Project, 1993
US Department of Education

F.A.S.T. BRAINSTORMING

FEELINGS--What feelings do you or others have about this problem? What feelings cause it? What feelings are a result of it? What needs to changed?

ALTERNATIVE VIEWPOINTS--What is the opposing viewpoint about this problem? Who would have a different opinion? Why?

SENSES--What do you see, taste, touch, smell, and hear as a result of this problem? Which of these are part of the cause?

TIME--How was this problem viewed a year ago? 10 years ago? 50 years ago? How will it be viewed a year from now? 10 years from now?

EPIC Workplace Learning Project, 1993
US Department of Education

THE FIVE *WHY'S?*

Learning Goals: • To distinguish between a symptom and a root cause of a given problem

Level: ■

Group Size: 10 - 12 participants

Time: 30 minutes

Preparation and Materials: Handout *Analyze Potential Causes*

Learning Activity:

Either as *a prelude to* or *a review of* a brainstorming activity, ask students the difference between a "symptom" of a problem and its "root cause." Next, introduce the Analyze Potential Causes handout and briefly explain how "The Five Why's?" work. Begin with the "first cause" at the top of the handout. Since the group is probably made up of tax payers who wonder how the government spends their money, present the following "Messy Monument" anecdote. Ask the group to analyze the potential cause by successively asking "why?":

> The monuments in Washington D.C. were slowly deteriorating because the city was using harsh chemicals to keep them clean of bird droppings.
>
> 1. Why were the birds messing up the monuments with their droppings?
> (Give the group a chance to answer.)
> Answer: They were there to eat the spiders that spun their webs on the monuments.
>
> 2. Why were there so many spiders on the monuments?
> (Give the group a chance to answer.)
> Answer: The spiders were eating the many insects that flew around the monuments.
>
> 3. Why were there so many insects flying around the monuments?
> (Give the group a chance to answer.)
> Answer: The insects were attracted to the monuments' flood lights.

***Discussion Questions**

1. Were the messy birds the root cause of the "Messy monuments?" If not, what was?

2. Was the decision to clean the monuments with harsh chemicals the best solution to the "messy monuments" problem? If not, what should the solution be?

SOLUTION: Reduce the length of time the lights were on at night.

***Variations** Have students apply the "five why's?" to a "real" problem being considered. Discuss whether or not the problem definition changes after the application of "The Five Why's?"

Remarks: It is not necessary to always ask "why?" 5 times, but the question should be asked until a satisfactory root cause is determined.

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

ANALYZE POTENTIAL CAUSES

First Cause: Customers' problems are not being resolved to their satisfaction.

KEY POINTS

To identify the root cause of a problem, re-analyze the most likely causes by asking "Why?" several times. It's easy to ask and answer the "Why?" question five or six times.

Construct a flow chart of the explanations for the identified causes.

Treat each cause as a problem in itself and use the problem-solving model to solve it.

WHY?
Because customer service personnel don't have the required technical information and support.
WHY?
Because customer support personnel have not been able to establish relationships with technical support people, and they fail to receive continual training to keep abreast of product changes.
WHY?
Because many customer service personnel do not have the technical interests to build upon.
WHY?
Because the hiring criteria and training programs emphasized for customer service personnel in the last two years have shifted toward the "people skills" side of customer service at the expense of "technical skills "and know=ledge.
WHY?
Because the customer focus the organization has established over the last two years emphasizes the "people side" of customer service. Management implemented the philosophy and approach so thoroughly they have lost sight of product-performance issues that are important to the customer.

EPIC Workplace Learning Project. 1993
US Department of Education

TARGETING THE PROBLEM

Learning Goals:

- To provide a systematic approach to identifying a problem
- To facilitate the definition of a problem in order to choose an appropriate solution

Level: ■

Group Size: Any

Time: 30 minutes

Preparation and Materials: Handout *Know the Problem...*,
Learning Activity: *Know the Problem* worksheet
Overhead Projector and transparency of handout
Flip chart or board

Distribute handout or project transparency. Explain to students that the four steps listed describe a systematic approach to identifying a problem and guarantee a more appropriate solution. Go through the following steps:

1) Give students about 10 minutes to brainstorm about existing problems in their workplace. Record these problems as they are given.

2) Ask the students to review the list and group the problems according to common characteristics (e.g. communication problems, money issues, telephone skills, computer problems, etc.). This is called "affinity grouping."

3) Have students isolate a "common thread" within each group.

4) Once that "common thread" has been identified for each problem area, have students write a problem statement of 10 words or less which clearly describes the problem. This is critical to choosing a solution because this statement effectively becomes the "target" at which the solution will be aimed. Students can now easily choose a problem they want to work on in the workshop or class.

***Discussion Questions** None

***Variations** None

Remarks: The group will enjoy the first two steps. Steps 3 and 4

become frustrating because students are so "solution-oriented" that these steps further delay the solution phase.

Step 4 can be difficult for the group because of the discipline necessary to describe a problem in 10 words or less. This is important because when problems are poorly defined and/or communicated, solutions are vague or inadequate. A problem statement clearly and efficiently communicates and targets the problem. Students tend to resist this phase because it sounds like they are being negative. However, using "negative" or "problem" vocabulary like ***inadequate, inefficient, inappropriate, insufficient,*** etc. does not indicate that one has a negative attitude. Rather, it shows that the individual can "positively" identify the problem in a simple, succinct manner.

References: None

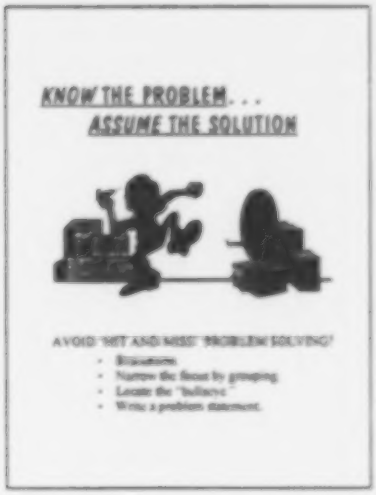
EPIC Workplace Learning Project, 1995
US Department of Education

KNOW THE PROBLEM. . .
ASSUME THE SOLUTION

AVOID "HIT AND MISS" PROBLEM SOLVING!

- Brainstorm.
- Narrow the focus by grouping.
- Locate the "bullseye."
- Write a problem statement.

EPIC Workplace Learning Project. 1995
US Department of Education



I. Brainstorm:

II. Affinity grouping: Group the ideas above according to "affinities" or common characteristics (e.g. communication problems, telephone problems, computer problems, money issues, etc.).

III. Locate the bullseye: For each group you identified above, describe a "common thread."

IV. Problem statement: Now that you've identified a "common thread" in each group, write a problem statement of 10 words or less.

EPIC Workplace Learning Project, 1995
US Department of Education

NARROWING THE FOCUS

Learning Goals:

- To lead students to further clarify a problem after one has been chosen

Level:

●

Group Size:

Any

Time:

10 minutes

Preparation and Materials:

Handout *Identifying the "Real" Problem*

Learning Activity:

After students have brainstormed to identify a problem and have consolidated the list through "affinity grouping" (grouping those problems that share common elements), ask them to apply the list of questions on the handout to their remaining choices. Explain that this will help them further clarify and isolate a problem so they can more effectively choose a solution. It is not necessary to apply all questions to each problem on the brainstorming list; rather, the questions serve as a guide toward more specific problem identification.

***Discussion Questions**

None

***Variations**

None

Remarks:

None

References:

None

EPIC Workplace Learning Project, 1995
US Department of Education

IDENTIFYING THE "*REAL*" PROBLEM

"Let's get to the bottom of this!"

- Who is affected by this?
- What's *really* wrong?
- Where does it occur?
- When does it happen?
- How does it happen?
- Why does it happen?
- What happens as a result?
- What are some possible causes?
- Describe the problem.
- Give an example.
- Say it another way.
- What's unknown?
- What do you know already?
- How often does this occur?
- How does it impact the organization?

EPIC Workplace Learning Project, 1995
US Department of Education

TRAPS TO AVOID

Learning Goals:

- To identify attitudes about problem solving and negative approaches to problem solving tasks

Level: ●

Group Size: Any

Time: 10 minutes

Preparation and Materials: Handout *Traps to Avoid*
Overhead projector and transperancy of handout

Learning Activity:

Distribute handout or project on overhead. Caution students to avoid these attitudes and approaches to the problem-solving task they are about to begin. Explain that they negatively influence the entire problem-solving process and often result in poorly chosen solutions and ineffective solution implementation.

***Discussion Questions**

1. What examples of these attitudes and approaches have you seen in your workplace?
2. Which ones, if any, are typical of your own problem-solving strategies?
3. How do these attitudes and approaches negatively impact a problem-solving task?

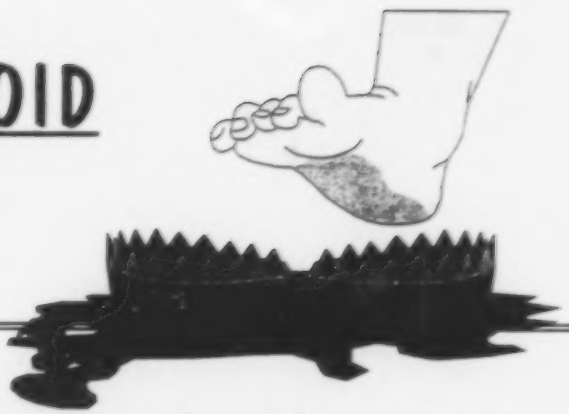
***Variations** None

Remarks: The first four items on the list are "attitudes" about problem solving. The remaining items are "approaches" to problem solving.

References: None

EPIC Workplace Learning Project. 1995
US Department of Education

TRAPS TO AVOID



- Only analytical people are good problem solvers.
- Some problems are too big to tackle.
- Solving problems is someone else's job.
- My intuition is sufficient.
- Quick fixes
- Solution jumping
- Band-aids
- Symptom solving
- Solving the wrong problem
- Settling

EPIC Workplace Learning Project. 1995
US Department of Education

SOLUTION IDENTIFICATION

After the problem has been clearly identified, a solution must be chosen. This section includes activities to foster the choice of an accurate, appropriate solution and one which also meets selected, relevant criteria. The solution phase must not be implemented unless and until a problem has been clearly identified and defined, otherwise the potential is increased for a "hit-and-miss" approach. The clearly defined problem becomes the "target" at which the solution is aimed. Several activities are presented in this section to help students recognize and choose solutions that specifically and appropriately target a problem.

SOLUTION FINDING GRID

Learning Goals:

- To provide a systematic, visual approach for choosing one of several solutions.
- To show the members of a problem-solving group that each person does not necessarily place the same weight on a particular solution.

Level: ■

Group Size: any number

Time: 15 - 30 minutes

Preparation and Materials: Overhead or large sample drawn on board
Handout: *Sample Solution Finding Grid* (1a)
Blank Solution Finding Grid (1b)

Learning Activity:

Pass out the sample Solution Finding Grid to all students and demonstrate on the overhead how to rank each of the five sample solutions relative to Criteria #1. At this point, cover up all the other columns except the first one. Then, have the students rank each solution from 1-5 according to Criteria #1. A ranking of 1 is the lowest and 5 is the highest. Each number in each column should appear only once. Move on to Criteria #2, covering up the other 3 columns, and rank the solutions as before. Proceed through the other criteria as necessary for the group to understand.

Walk around the room to determine if students are doing this process correctly. After guiding them through Criteria #1, #2, and #3, most students will have the idea and can proceed on their own. Several students will have difficulty grasping the "ranking" concept and will put several 3's or 2's in a column.

***Discussion Questions**

1. Have you ever weighed a solution according to a set of criteria before?
2. What did this ranking procedure show you about choosing a particular solution.

***Variations**

Remarks: This exercise can become frustrating for students if the concept of "ranking" each solution according to each criteria

is not clearly made. Encourage students not to spend a lot of time ranking decisions on the sample Solution Finding Grid. They should make rather arbitrary choices so they can complete this practice and move on to the blank Solution Finding Grid.

References:

Flack, Jerry D. *Inventing Inventions and Inventors.* Englewood, Colorado: Teacher Ideas Press, 1989.

EPIC Workplace Learning Project, 1993
US Department of Education

SOLUTION-FINDING GRID

PROBLEM STATEMENT: ***Lack of communication between management and shift workers; employees feel disconnected from "big picture".***

Select the five possible solutions that you think are the most promising. List them on the left side of the grid. Then, rank each of the solutions according to each criterion. The top ranking should get a "5", the lowest a "1". Do one criterion at a time, and when you have ranked each possible solution accordingly, move onto the next criterion. After you have ranked each solution according to all the criteria, go back and add up the numbers left to right for each possible solution. Record the sum in the column marked "TOTAL". Use this information to choose your best solution.

	CRITERIA					
Possible Solutions:	**#1**	**#2**	**#3**	**#4**	**#5**	**Total**
1. Management should act on problems.						
2. Assigned jobs should be done.						
3. Use bulletin boards or make better use of them.						
4. Create problem-solving teams.						
5. More one-on-one supervisors.						

CRITERIA:

1. The employees will like it and do it.
2. The supervisors will like it and do it.
3. It will improve communication.
4. It is cost effective.
5. It is the fastest and easiest to implement.

EPIC Workplace Learning Project 1995
US Department of Education

SOLUTION-FINDING GRID

PROBLEM STATEMENT:_____

_____

Select the five possible solutions that you think are the most promising. List them on the left side of the grid. Then, rank each of the solutions according to each criterion. The top ranking should get a "5", the lowest a "1". Do one criterion at a time, and when you have ranked each possible solution accordingly, move on to the next criterion. After you have ranked each solution according to all the criteria, go back and add up the numbers left to right for each possible solution. Record the sum in the column marked "TOTAL". Use this information to choose your best solution.

	CRITERIA					
Possible Solutions:	**#1**	**#2**	**#3**	**#4**	**#5**	**Total**
1.						
2.						
3						
4.						
5.						

CRITERIA:

1. _____

2. _____

3. _____

4. _____

5. _____

EPIC Workplace Learning Project, 1995
US Department of Education

THE CHRISTMAS VACATION PROBLEM

Learning Goals:
- To practice using the solution-finding grid
- To learn how to select appropriate criteria

Level: ■

Group Size: 2 or more students

Time: 30 - 40 minutes

Preparation and Materials: Handout *The Christmas Vacation Problem*
Handout *Solution-Finding Grid*

Learning Activity:

Give students the handout describing the problem. Have them generate a list of criteria which would be appropriate to use to determine the optimal solution. Then, have them select the top five criteria and use them with the Solution-Finding Grid (Solution Identification 1b in this manual) to come up with the best solution.

*** Discussion Questions**

1. How did you decide which criteria to use to evaluate the solutions?
2. Do you feel the Solution-Finding Grid led you to the optimal solution?

*** Variations:** None

Remarks: While using the Solution-Finding Grid ("Solution Identification 1", in this section), students may find it difficult to rank certain items from 5 to 1 . You may want to discuss the possibility of ranking several items equally (e.g. both of these options would be free, so they could both receive 5's on the cost criteria.)

References: None

EPIC Workplace Learning Project, 1993
US Department of Education

THE CHRISTMAS VACATION PROBLEM

The problem: You and your spouse have 7 vacation days per year. Last year you spent Christmas with his family in Canada. Your family lives in Florida. You find that spending time with your family tends to be extremely stressful. You have a two bedroom house. Your family consists of 5 people other than yourself. His family consists of 2 people other than himself.

The possible solutions:

- Go to his family's house for a second year.
- Go to your family's house.
- Invite both families to your house.
- Invite one or the other family to your house.
- Go to Hawaii on vacation during Christmas.
- Celebrate Christmas together alone at home.
- Celebrate Christmas with one family and New Year's with the other.
- Have your spouse visit his family, and you visit yours.

Criteria?

1.
2.
3.
4.
5.

EPIC Workplace Learning Project, 1993
US Department of Education

SPECIAL INTERESTS ANALYSIS

Learning Goals:

- To consider the interests of special groups which may be significantly affected by the particular solution to a problem

Level: ■

Group Size: Any

Time: 10 minutes

Preparation and Materials: Handout *Sample Special Interests Analysis Form*
Blank Special Interests Analysis Form

Learning Activity:

Have students review the sample. Then, have students jot down on the blank form any special interest groups that a solution to the problem could potentially affect. Students should also identify the particular vested interest of each group. Then, the class or each problem-solving team can discuss the comments and determine if these considerations will alter the criteria or soutions being considered.

***Discussion Questions**

1. Did you think about these particular groups when you were brainstorming for solutions?
2. Does this special interest analysis make a difference to you or affect your choice of solutions? If not, why not? If so, why?

***Variations** None

Remarks: None

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

SPECIAL INTERESTS ANALYSIS

PARTIES INVOLVED	CONCERNS AND INTERESTS
1. Your customer	High quality
2. Your manager	Cost control
3. Team goals	Everyone participates
4. Work center goals	Reduce scrap/spoilage
5. Corporate ideals	Safe for the environment
6.	
7.	
8.	

EPIC Workplace Learning Project. 1995
US Department of Education

SPECIAL INTERESTS ANALYSIS

PARTIES INVOLVED	CONCERNS AND INTERESTS
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

EPIC Workplace Learning Project. 1995
US Department of Education

CRITERIA FOR CHOOSING SOLUTIONS

Learning Goals:

- To focus students' thinking on factors relevant to the choice of a particular solution.
- To alleviate indecision when choosing solutions

Level: ■

Group Size: Any

Time: 15 minutes

Preparation and Materials: Handout *Possible Criteria for Selecting a Solution*

Learning Activity:

Have students review the handout and the criteria listed. Ask them if other criteria are relevant to their problem. If so, add those to the list.

If this activity is done in conjunction with the Solution Finding Grid (located in this section as "Solution Identification 1"), have students check off the five criteria they think are the most relevant to their problem. Transfer these criteria to the blank Solution Finding Grid.

***Discussion Questions**

1. Has listing or reviewing the criteria helped you develop a solution identification strategy?

***Variations** None

Remarks: None

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

POSSIBLE CRITERIA FOR SELECTING A SOLUTION

- It will be the easiest to implement.
- It has the most long-term effect.
- It will be the most popular with the personnel or group(s) directly involved.
- It is the most ethical.
- It can be the most rapidly implemented.
- Management will like it.
- It makes good business sense.
- It is the best use of money.
- It is the best use of time.
- It is the most satisfactory short-term solution.
-
-
-
-

EPIC Workplace Learning Program. 1995
US Department of Education

A CONTINGENCY DIAGRAM

Learning Goals:

- To familiarize students with an idea-generation tool that takes advantage of the tendency to focus on the negative in a problem-solving situation.

Level: ■

Group Size: Any

Time: 30 minutes

Preparation and Materials: Handout *Contingency Diagram*
Flip chart; red, green, and black markers

Learning Activity:

Draw a "sunburst" on the flip chart similar to that on the handout. Write a goal statement [for example "Have creative teams."] in the bottom left corner of the diagram. Using a red marker [red for negative thought], have the group brainstorm the reasons why that goal might not be met or the target situation doesn't currently exist, and record the responses on the "rays" of the diagram. Next, using a green marker, have them give a positive solution for every negative one. Finally, have pairs or groups practice using the Contingency Diagram on their own. Suggest a suitable goal statement or have them decide on one. Lead the group through a discussion of their conclusions or reactions to the Contingency Diagram. Use the handout as a review of how the tool works and for future reference.

***Discussion Questions**

1. When solving problems, do <u>you</u> tend to dwell on positive or negative aspects?
2. Where would you use the Contingency Diagram in the problem solving process?

Remarks: This works effectively as a combination ice-breaker and brainstorming exercise.

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

CONTINGENCY DIAGRAM

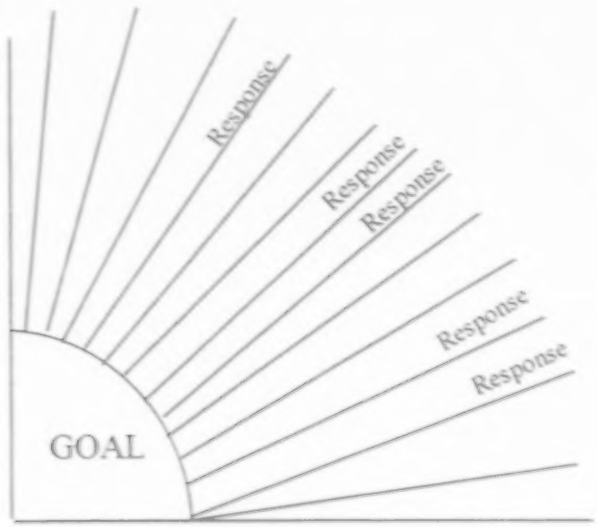
- This diagram is an idea-generation tool that takes advantage of our tendency to focus on the negative aspects of a situation.

- STEP 1: Construct the contingency diagram framework based on the design at the bottom of the page. In the "sun," place your goal or objective. Phrase it as positively as possible. For example, an objective might be, "We want to have effective, efficient meetings."

- STEP 2: Using standard brainstorming techniques, gather responses to the question, "What kinds of things might prevent this objective from being met?" Place each response on a separate "ray" of the diagram. You may need to construct additional diagrams. Use a red marker to record these responses (red = "negative thought")

- STEP 3: After collecting responses, ensure everyone understands the meaning of each response. Consolidate the responses whenever possible so that this list is reduced to a manageable set of causes. Affinity grouping or a cause-effect diagram could be helpful here to study relationships betwen the brainstormed causes.

- STEP 4: Now, take each response in turn and ask the question, "What can we do to prevent this particular event from occurring and blocking the objective?" Use a green marker to record these responses (green = "positive solutions"). At this point, you have moved from what the group would like to see to some concrete items that they can do to achieve the goal.



EPIC Workplace Learning Project, 1995
US Department of Education

LOST BALL PROBLEM #1

Learning Goals:

- To brainstorm a solution to the problem
- To focus on what the known factors are in the problem before tackling a solution

Level: ●

Group Size: 2 or more, in pairs

Time: 5 minutes

Preparation and Materials: Handout *Lost Ball Problem* #1

Learning Activity:

Divide the group into pairs and distribute the handout. Give them 5 minutes to brainstorm together on a solution to this problem. Ask the students to share the possible solutions among the group but to refrain from analyzing the solutions or commenting on them. When each pair has shared, initiate a discussion of the following questions:

***Discussion Questions**

1. What are the "known" factors in this problem?
2. What are the variables, if any?
3. What else do you need to know to solve this problem better?

***Variations** None

Remarks: None

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

LOST BALL PROBLEM #1

At a picnic in the park, some children accidentally dropped a wooden ball down a pipe. The pipe is a hollow cylinder that is cemented to the round. What would you suggest these kids do to get their ball out of the pipe?

EPIC Workplace Learning Project, 1995
US Department of Education

LOST BALL PROBLEM #2

Learning Goals:

- To brainstorm a solution to the problem
- To focus on what the known factors are in the problem before tackling a solution

Level: ◆

Group Size: 2 or more, in pairs

Time: 5 - 10 minutes

Preparation and Materials: Handout *Lost Ball Problem* #2

Learning Activity:

Divide the group into pairs and distribute the handout. Give them 5 - 10 minutes to brainstorm together on a solution to this problem. Ask the students to share the possible solutions among the group but to refrain from analyzing the solutions or commenting on them. When each pair has shared, initiate a discussion of the following questions:

***Discussion Questions**

1. What are the "known" factors in this problem?
2. What are the variables, if any?
3. Did you bring any "prior knowledge" to solving this problem? If so, what?

***Variations** None

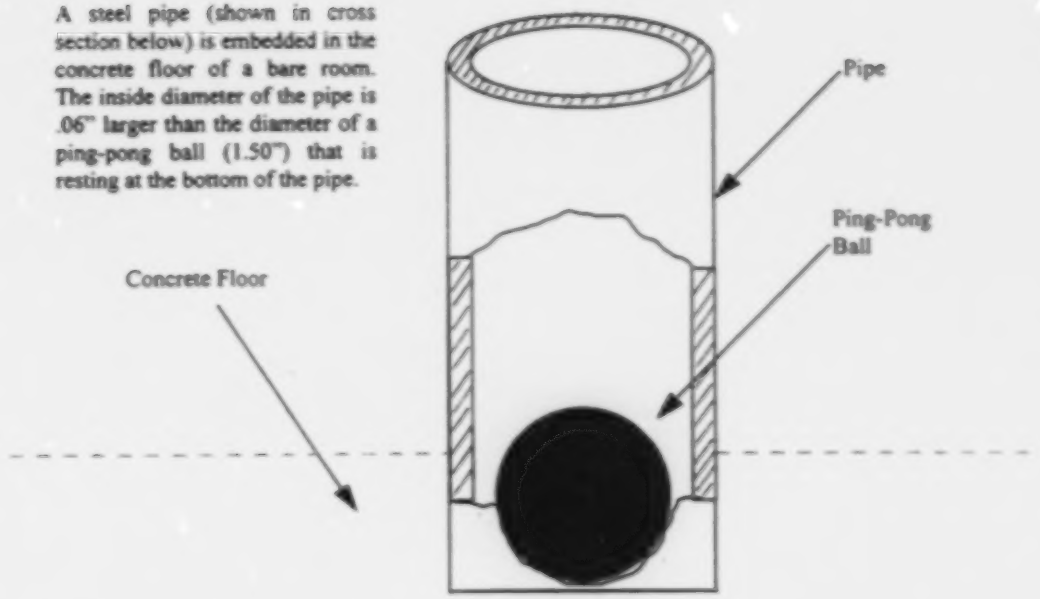
Remarks: None

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

LOST BALL PROBLEM #2

A steel pipe (shown in cross section below) is embedded in the concrete floor of a bare room. The inside diameter of the pipe is .06" larger than the diameter of a ping-pong ball (1.50") that is resting at the bottom of the pipe.



You and your group are in the room with the following objects:

100' of clothesline	a file
a carpenter's hammer	a wire coat hanger
a box of Wheaties	a monkey wrench
a chisel	a light bulb

In 5 minutes, list as many ways as you can think of to get the ball out of the pipe without damaging the ball, pipe, or floor.

EPIC Workplace Learning Project, 1995
US Department of Education

OPEN THE DOOR TO A SOLUTION

Learning Goals:

- To prompt a "reality check" before choosing a solution
- To encourage students to think about what is possible and feasible for the implementation of a solution within their workplace environment

Level: ●

Group Size: Any

Time: 10 - 20 minutes

Preparation and Materials: Handout *Open the Door to a Solution*
Overhead projector and transparency of handout

Learning Activity:

Distribute handouts or project the transparency and initiate a discussion on the questions.

***Discussion Questions** None

***Variations** Pairs or small groups could discuss these questions.

Remarks: This "reality check" is important because the solutions that look the best in the classroom are often not realistic. Discussing these questions tends to prevent that. These questions are also useful in identifying criteria for a solution.

References: None

EPIC Workplace Learning Project, 1995
US Department of Education

OPEN THE DOOR TO A SOLUTION

- Who owns the problem?
- How much of it can I/we change?
- Is it in my/our/ their area?
- Can I/we only change my/our reaction to it?
- What are my/our boundaries and/or limitations?

EPIC Workplace Learning Project, 1995
US Department of Education

SOLUTION IMPLEMENTATION

Implementing the solution is the hardest phase of the problem-solving process because it requires action and accountability for follow-through. Essentially, this is where "the rubber meets the road." This section includes activities to assist in the sequenced implementation of a particular solution to a problem. Consideration of the task, its integral action-steps, the various people involved, and time constraints are important for the successful implementation of any solution to a given problem. Activities leading participants through all of these elements are all included in this section.

EPIC Workplace Learning Project. 1995
US Department of Education

EVALUATION OF ENVIRONMENT

Learning Goals:

- To evaluate the environment for implementing a plan or solution

Level: ■

Group Size: 2 or more students

Time: 20 - 30 minutes

Preparation and Materials: None

Learning Activity:

Ask students to evaluate the workplace or their department for the potential implementation of a solution to a workplace problem. The group can work together or separately. The framework for the evaluation is a **SWOT** (**S**trengths, **W**eaknesses, **O**pportunities, **T**hreats) analysis.

*** Discussion Questions**

1. What are the strengths of your environment?
2. What are the weaknesses?
3. What opportunities do you see?
4. What barriers (threats) stand in the way of implementation?
5. With this information, would you implement the solution or plan? If not, what would need to be done?

*** Variations:** Separate students into four groups and have each group work on one of the four factors. Have each group present to the class or argue for or against implementation based on the information from their area.

Remarks: This exercise is a good tool for examining how realistic a particular solution or plan may be for a particular environment. It also will raise awareness of new problems that may be created by solving the problem at hand.

WORD LADDERS

Learning Goals:

- To prompt use of sequential thinking
- To introduce sequential implementation of solution

Level: ■

Group Size: Any

Time: 5-10 minutes

Preparation and Materials: Handout *Word Ladders*, *Word Ladders Answer Sheet*

Learning Activity:

Distribute *Word Ladders* handout and ask students to complete the word sequences according to the instructions. When everyone is finished, distribute the *Answer Sheet*. Inform the students that other sequences are possible.

***Discussion Questions**

1. What does this exercise have to do with solution implementation?
2. Do you usually approach the implementation of a solution sequentially?

***Variations** None

Remarks: The instructor can use this exercise as a simple brain teaser or as a vehicle to introduce students to sequential implementation of a solution. This exercise also serves as a lead-in to filling out an action plan (located in this section as Solution Implementation 3).

References: None

WORD LADDERS

Instructions: Change one letter of the top word to form the second word. Then change one letter of the second word to make the third word. Change one letter of the third word to end up with the word at the bottom of the ladder.

WARM	RATS	LOSE	WALK
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
COLD	MICE	FIND	MILE

WORD LADDERS

*(Answer Sheet)

warm	rats	lose	walk
ward	rate	lone	wall
card	mate	line	mall
cord	mite	fine	male
cold	mice	find	mile

*There are other possible sequences within each of these ladders.

DEVELOPING AN IMPLEMENTATION PLAN

Learning Goals:

- To provide a systematic approach to implementing a solution
- To encourage students to actually work out a solution rather than just suggest one

Level: ■

Group Size: Any

Time: 20-30 minutes

Preparation and Materials: Handout *Implementing the Plan*
Develop an Implementation Plan (overhead also)
Implementation Plan

Learning Activity:

When students have reached the solution implementation phase of the problem-solving process, pass out the "Implementing the Plan" handout. Discuss with students how critical it is in the problem-solving process to follow-through with a written implementation plan of the solution. Review the check list of questions on this handout. Pass out the "Develop an Implementation Plan" handout and point out on the overhead the use of a specific Problem Statement and Solution Statement. Point out the specific action steps and emphasize their chronological sequencing. Distribute the blank "Implementation Plan" and ask students in pairs or groups to work through the action steps of the solution they have selected for their problem.

***Discussion Questions**

1. How do you usually approach solutions to a problem? Randomly or systematically?
2. Was it hard to think sequentially?
3. Will having done this plan make you more patient with those who are working on solutions to problems you have a vested interest in?

***Variations**

Remarks: Obviously, the plan is not limited to the 8 or 9 steps. This grid serves only as a place to begin. The students can submit the completed plan to whoever is in authority to initiate such a plan. This action really creates "buy-in" for

the group if they know that "someone who matters" will be reviewing their work. This action does not guarantee that the plan will be initiated, but hopefully it will be reviewed.

Emphasize that this written plan forces accountability and assigns responsibility to the working out of a solution. Having the plan in writing also serves as a check list and facilitates monitoring the action plan.

IMPLEMENTING THE PLAN

- Who will implement the solution?
- When will it be implemented?
- How will it be implemented?
- Where will it be done?
- Can you check to see if the solution is working while it's being implemented?
- When the solution is in place, can you check its effectiveness?
- Does it solve the problems it was intended to solve?
- Does it create new problems that have to be addressed?

EPIC Workplace Learning Project, 1995
US Department of Education

DEVELOP AN IMPLEMENTATION PLAN

Problem Statement: *Inadequate staffing on shifts to cover departmental tasks during peak service times.*

Solution: *Redistribute departmental employees and jobs in proportion to shift load, and prioritize specific shift duties.*

Write a concise plan specifying actions, steps, dates, and responsibility for implementation of solution:

- List the necessary actions steps
- Number the steps in sequence
- Specify the overall completion date
- Specify start and finish dates for each step
- Make someone responsible for each step
- Distribute copies of the plan to everyone involved.

ACTION STEPS	START FINISH	WHO'S RESPONSIBLE?
1. Identify specific shift changes and new duties.	2/15-2/22	Me
2. Write descriptions of changes and new duties for each department employee	2/23-3/10	Marion
3. Revise and approve descriptions of changes.	3/13-3/20	Me
4. Prepare description of changes by shift	3/21-3/28	Terry
5. Prioritize duties by shift.	3/21-3/28	Terry
6. Verify employee addresses and telephone numbers.	3/21-3/28	Lee
7. Prepare cover letter announcing department changes.	by 3/31	Lee
8. Duplicate and distribute letters to each employee through workplace mail system.	by 4/5	Jan

IMPLEMENTATION PLAN

Problem Statement:

_____

_____

Solution:

_____

_____

Implementation Plan:

ACTION STEPS	START/FINISH DATES	WHO'S RESPONSIBLE?
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Submitted by: Problem Solving Class/Workshop
Dates:

BLOOM'S TAXONOMY CIRCLE

Learning Goals:
- To provide ideas for specific action steps in the implementation plan

Level: ■

Group Size: Any

Time: 10 - 15 minutes

Preparation and Materials: Handout *Bloom's Taxonomy Circle*
Overhead of above

Learning Activity:

Distribute the handouts when the students are in the implementation phase of a problem solving task. Demonstrate on the overhead the difference between the tiers:

1. The inner tier includes five Basic Approaches toward the implementation of a solution.
2. The middle tier lists Activities commensurate with each of the Basic Approaches.
3. The outer tier lists actual Products or results of the previous activities.

Ask students to use the ideas found in the tiers to *apply, comprehend and know, analyze, evaluate, or synthesize* something within their implementation plan.

***Discussion Questions**

1. Did this circle give you ideas that you might not have thought of?
2. Did the use of this circle facilitate or complicate drafting your implementation plan?

Remarks: This exercise helps students provide nouns and verbs to use in the implementation plan. At this point in the problem-solving process, students may feel a little "brain-dead" and appreciate these products and activities. They need to learn to use the circle effectively.

References:

Clark, Barbara. *Growing up Gifted.* Columbus: Merril Publishing Co., 1979.

BLOOM'S TAXONOMY CIRCLE
of Activities and Products

ANALYZING THE PROCESS

The last and most often ignored phase of the problem-solving process is the "metacognitive" phase, analyzing the process just completed. This section presents discussion questions and activities to aid in the analysis of the problem-solving task and the results The problem-solver must now ask, "What could I have done differently or better?" and "How would I have changed the process?" These questions serve as a healthy wrap-up to the presentation of any problem-solving process, simulation, or task. The answers and analysis then fuel the problem-solving process and strategies for the next task.

THE FINAL STEP

Learning Goals:

- To provide closure to a problem-solving task
- To encourage students to take the time to review their problem-solving strategies and the results of a problem-solving task

Level: ●

Group Size: Any

Time: 10-20 minutes

Preparation and Materials: Handout *Time for Metacognition*

Learning Activity:

Distribute the handout and initiate a discussion relevant to the problem-solving process or project just completed. Guide the discussion as needed in order to focus attention on future projects or tasks. Explain that "metacognition" involves thinking about or analyzing the thinking process just completed--much the same way as baseball players analyzing a game afterwards.

***Discussion Questions** None

***Variations** None

Remarks: This activity serves as an assessment of the process, the results of the problem-solving task, and the students' demonstrated strengths and weaknesses.

References: None

TIME FOR METACOGNITION

- What part of the process was the most productive?
- What part was the least productive?
- What should you/could you do differently next time?
- How did the solution finally come to you or your group?
- Could this task have been better accomplished by an individual? A group?

SECTION VIII

INDIVIDUAL VS. GROUP PROBLEM SOLVING

Many problems in the workplace must be solved on the spot by an individual; however, more often than not, problems lend themselves to group problem-solving (e.g. committees, teams, work groups, task forces, etc.) Although both processes employ similar strategies, these two approaches do differ. The activities in this section foster the recognition of the strengths and weaknesses in each process and the awareness of when one is beneficial over the other for a given situation.

THE CAMPING PROBLEM

Learning Goals:

- To understand how to reach consensus
- To recognize the advantages and disadvantages of team problem solving

Level: ●

Group Size: 3 or more students

Time: 45 minutes

Preparation and Materials: Handout *The Camping Problem*

Learning Activity:

Have each student complete "The Camping Problem" individually. They should rank each of the items in order of importance up to the tenth most important item. After they have completed the handout, have them work in groups of 3 to solve the problem a second time.

*** Discussion Questions**

1. What were some of the advantages of solving this problem as a group?
2. What were some of the disadvantages?

*** Variations:** If time is limited, have the students pick the five items that are most important.

Remarks: Most students will focus on the disadvantages of team problem solving when completing this exercise. This attitude may stem in part from their view that this is a life or death situation, and they are less willing to compromise.

References:

Bladen, Ashby. *How to Cope with the Developing Financial Crisis*. New York: McGraw Hill,1979.

EPIC Workplace Learning Project, 1995
US Department of Education

THE CAMPING PROBLEM

You and three friends were camping in the mountains of Utah one summer weekend. After the weekend, while you are on the long trip home, the car breaks down. You are in the desert and the nearest town is 200 miles away. You are on a very isolated dirt road and it is unlikely that you will encounter any other motorists. Your best chance for survival is to reach the nearest town. You have the following items in your car. You will be able to carry only ten items. What would you do? What would be the most important item, the second most, etc. up to the tenth item of importance? Put a "1" beside the most important item, a "2" by the second most important, etc.

_____	a box of matches	_____	rope
_____	a Swiss-army knife	_____	an ax
_____	20 apples	_____	an inflatable mattress
_____	hats	_____	a bag of charcoal
_____	3 gallons of water	_____	marshmallows
_____	a first aid kit	_____	1 gallon of water
_____	a camping tent	_____	insect repellent
_____	a flashlight	_____	folding chairs
_____	5 cans of beans	_____	a sleeping bag
_____	pots and pans	_____	ice chest with a 6 pack of Heineken

If you could bring one more item which is not on the list, what would you bring?

_____

EPIC Workplace Learning Project, 1995
US Department of Education

NASA EXERCISE

Learning Goals:

- To demonstrate the value of group problem-solving
- To implement problem-solving techniques to achieve concensus

Level: ■ ◆

Group Size: Groups of 4-6

Time: 30 minutes

Preparation and Materials: Handouts *NASA Exercise Individual Worksheet*
NASA Exercise Group Worksheet
NASA Exercise Answer Sheet
NASA Exercise Scoring Sheet

Learning Activity:

Distribute the *"NASA Exercise Individual Worksheet"* and allow students about 5-10 minutes to complete it. Pass out the *"NASA Exercise Group Worksheet"* and read through the directions to insure effective group dynamics. Give the group about 20 minutes to rank the items and reach consensus. Pass out the *"NASA Exercise Answer Sheet" and the "NASA Exercise Scoring Sheet"* and follow the directions on the scoring sheet.

***Discussion Questions**

1. What was the average individual score? What were the group scores?
2. What were the dynamics within the group that enabled the results to be more accurate than the individual results?
3. Which process did you prefer?
4. Did you feel included or left out within the group? Did someone dominate the group process or did people have equal say?
5. When do you think one problem resolution method is preferable to the other?

***Variations** See "Camping Problem" in this section (Individual vs. Group 1).

Remarks: For the group process to work well, the participants must agree on the rules to preclude someone from dominating. This exercise is not appropriate for a group with little education or little interest in science or technology; they will have much less "schema" (pre-knowledge) to bring to the problem-solving task and might feel "stupid" or intimidated and just back out all together. Choose the Camping Problem instead or draft a similar activity which more accurately pulls from their experience.

References: None

NASA EXERCISE: Individual Worksheet

Instructions:

You are a member of a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During landing, much of the equipment aboard was damaged, and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200-mile trip. The 15 items listed below are intact and undamaged after landing. Your task is to rank order them in terms of their importance to your crew who will attempt to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on, through number 15, the least important.

_____ Box of matches
_____ Food concentrate
_____ 50 feet of nylon rope
_____ Parachute silk
_____ Portable heating unit
_____ Two .45 calibre pistols
_____ One case dehydrated milk
_____ Two 100-lb. tanks of oxygen
_____ Stellar map of the moon's constellation
_____ Life raft
_____ Magnetic compass
_____ 5 gallons of water
_____ Signal flares
_____ First-Aid kit containing injection needles
_____ Solar-powered FM receiver-transmitter

NASA EXERCISE: Group Worksheet

Instructions:

You are a member of a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During landing, much of the equipment aboard was damaged, and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200-mile trip. The 15 items listed below are intact and undamaged after landing. Your task is to rank order them in terms of their importance to your crew who will attempt to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on, through number 15, the least important.

_____ Box of matches
_____ Food concentrate
_____ 50 feet of nylon rope
_____ Parachute silk
_____ Portable heating unit
_____ Two .45 calibre pistols
_____ One case dehydrated milk
_____ Two 100-lb. tanks of oxygen
_____ Stellar map of the moon's constellation
_____ Life raft
_____ Magnetic compass
_____ 5 gallons of water
_____ Signal flares
_____ First-Aid kit containing injection needles
_____ Solar-powered FM receiver-transmitter

NASA EXERCISE: Answer Sheet

15	Box of matches	No oxygen on moon
4	Food concentrate	Can live for some time without food
6	50 feet of nylon rope	For travel over rough terrain
8	Parachute silk	For carrying
13	Portable heating unit	Lighted side of moon is hot
11	Two .45 calibre pistols	Possible use for propulsion
12	One case dehydrated milk	Needs water to work
1	Two 100-lb. tanks of oxygen	No air on moon
3	Stellar map of the moon's constellation	Needed for navigation
9	Life raft	Possible use for shelter or carrying
14	Magnetic compass	Magnetic field is different from earth's
2	5 gallons of water	You can't live long without water
10	Signal flares	No oxygen
7	First-Aid kit containing injection needles	Kit might be needed, but needles are useless
5	Solar-powered FM receiver-transmitter	Use for communication

NASA EXERCISE: Scoring Sheet

DIRECTIONS FOR SCORING:

1. Determine the net difference between the rankings on the Individual Worksheet and the correct NASA rankings on the Answer Sheet. For example, if an item was ranked as "9" and the correct NASA ranking was "12", the net difference is "3". The score for that particular item becomes "3".

2. Total these net scores for a total Individual Score.

3. Next, total all the individual scores and divide by the number of participants to arrive at an Average Individual Score.

4. Score the net difference between the Group Worksheet rankings and the correct NASA rankings.

5. Total these scores for a Group Score.

6. Compare the Average Individual Score with the Group Score.

Rating:
0 - 20 Excellent
20 - 30 Good
30 - 40 Average
40 - 50 Fair
over 50 Poor

NAME THAT TOWN

Learning Goals:

- To show students the benefit of solving problems as a team rather than individually.

Level: ●

Group Size: Any

Time: 15 minutes

Preparation and Materials: None

Learning Activity:

Ask each student to list as many small towns as they can think of with populations under 5,000. Allow them to work on their lists for one minute. Then, divide the class into small groups of seven or fewer people per group. Ask each group to compile a list of small towns compiled from the individual lists and add any additional towns that the group can identify.

***Discussion Questions**

1. What did you learn from doing this activity alone and as a group?

***Variations** None

Remarks: If necessary, help the group recognize that having worked together broadened the range of answers. The cartoon cited below can facilitate a discussion about the merits of group problem solving over individual problem solving.

References:

Watterson, Bill. "Calvin & Hobbes," February 2, 1994 Universal Press Syndicate

EPIC Workplace Learning Project, 1995
US Department of Education

SAMPLE 4-HOUR WORKSHOP

(Modified Outline)

[The activities below are included in this manual and may easily be interchanged with others depending upon the specific needs and level of the group.]

Segment I - (60 minutes)

Rationale: Underlying successful Problem Solving is the ability to stretch one's thinking, to step out of one's mental box. This segment includes an enjoyable beginning to building ***fluency, flexibility, elaboration, and originality*** in thinking and problem solving.. This segment creates a foundation for the remaining segments. As participants meet roadblocks, they are reminded to step outside their mental boxes, to look at the problem again from a different perspective. This is an equally important "team-building" concept.

Learning Intentions:

Participants will reflect on their own problem-solving strategies.

Participants will be introduced to the "Ready-Aim-Fire" problem-solving strategy.

Participants will recognize the need to actively look at problems from a variety of perspectives.

Participants will practice ways to improve the ***fluency, flexibility, elaboration,*** and ***originality*** in their thinking.

I. ICE-BREAKER/SELF-ASSESSMENT
- A. "Tortoise, Hare, Thoroughbred"
- B. "Problem Solving Self-Assessment"

II. DESCRIPTION OF THE WORKSHOP
- A. "Problem Solving is a Process"
- B. "Ready-Aim-Fire"

III. LOOSEN THE BRAIN FOR PROBLEM SOLVING
- A. FLUENCY
  1. "How Many Squares Are There?"
  2. "Bird Brain"
- B. FLEXIBILITY
  1. "Banana Split"

EPIC Workplace Learning Project, 1993
US Department of Education

2. "Join the Dots"
3. "What Do You See?"

C. ORIGINALITY
1. "Half of 8/Ate/Eight"

D. ELABORATION
1. Picture Completion

(This can be done last in this series so that participants can post their pictures on the wall as they take a 10-minute break before the next segment. This also allows all participants to view one another's pictures; this proves to be revealing.

Segment II - (60-70 minutes)

Rationale: In this session, the READY-AIM-FIRE problem-solving technique will be introduced. Successful problem solving depends on choosing a good problem. The best problems are well-defined and within the jurisdiction of the problem solvers. Working together as a group to ferret out a problem that is neither too simple nor too unwieldy is the goal of this session. The READY-AIM-FIRE technique will cover four segments of this workshop.

Learning Intentions:

Participants will recognize problem-solving as a systematic, thoughtful process rather than a haphazard "quick-fix".

Participants will ***brainstorm*** to define the problem, ***identify*** the key problem, and ***narrow the focus*** to manage the problem through analysis and critical thinking. Participants will *write a problem statement* clearly defining the problem.

IV. DEFINE THE PROBLEM (READY)

A. "Traps to Avoid"
B. "Brainstorming Guidelines"
C. "Things That Come in 3's"
D. "Targeting the Problem"
1. Brainstorm to identify a workplace problem (10 minutes)
2. Divide the list into affinity groups.
3. Choose one of the identified groups.
4. Identify the real problem
5. Further narrow the focus; define the problem; write a problem statement

EPIC Workplace Learning Project, 1995
US Department of Education

Segment III - (45 minutes)

Rationale: Now that the problem has been identified and further discussed, it's necessary to brainstorm for workable solutions. Again, participants need to step out of their boxes and think about what new ways they can find to approach familiar problems? The AIM stage of the READY-AIM-FIRE problem-solving technique will be introduced and participants will generate and explore solutions, and examine criteria. The Solution-Finding Grid allows participants to weigh options in a new way.

Learning Intentions:

Participants will brainstorm for workable solutions, and weigh those solutions against criteria.

Participants will use the solution-finding grid to determine the most appropriate solution to the identified problem.

V. GENERATE AND EXPLORE SOLUTIONS (AIM)

A. "Count the F's"
B. "Open the Door to a Solution"
C. Brainstorm for a workable solution defined in the problem statement.
D. Examine criteria: "Possible Criteria for Selecting a Solution"
E. "Solution-Finding Grid" (Sample)
F. "Solution-Finding Grid" (Blank)
G. Write a Solution Statement

Segment IV - (20 minutes)

Rationale: Once the best and most promising solution is chosen, the next step is to implement it. This is best accomplished by identifying specific steps to take, start and finish dates, and who is responsible. The "FIRE" phase will be introduced in this session. Participants will carry their "I-think-we-should" statements into action and implementation. This is the stage where "the rubber meets the road" and where many back out of a problem-solving task. This stage is important because it gives credence to all that has been accomplished thus far.

Learning Intentions:

Participants will develop an implementation plan to activate the solution.

VI. IMPLEMENT THE SOLUTION (FIRE)

A. "Word Ladders"
B. "Develop an Implementation Plan" (Sample)

C. "Develop an Implementation Plan" (Blank)

Segment V - (30 minutes)

Rationale: The final step in problem solving is to review the entire problem-solving process and analyze what went well or poorly and why. This metacognitive process helps participants recognize their own personal strengths and weaknesses, identify ways to build on their assets, and compensate for or improve their weaknesses.

Learning Intentions:

Participants will recognize the value of reflecting on their problem-solving process (Metacognition).

Participants will identify strengths and weaknesses of their problem-solving skills.

VI. REVIEW THE PROCESS
- A. "Time for Metacognition"
- B. Evaluation of workshop

EPIC Workplace Learning Project, 1995
US Department of Education